HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Warm Springs National Fish Hatchery
Species or Hatchery Stock:	Warm Springs River Spring Chinook Salmon
Agency/Operator:	United States Fish and Wildlife Service
Watershed and Region:	Deschutes River, Oregon, Mid-Columbia River
Date Submitted:	08/16/04
Date Last Updated:	08/16/04

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Warm Springs National Fish Hatchery (NFH) Spring Chinook Salmon Program

1.2) Species and population (or stock) under propagation, and ESA status.

Warm Springs River spring Chinook salmon (*Oncorhynchus tshawytscha*), unlisted

1.3) Responsible organization and individuals

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Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

Confederated Tribes of the Warm Springs Reservation of Oregon- fisheries management
USFWS Columbia River Fisheries Program Office- fisheries technical support
Oregon Department of Fish and Wildlife- co-manager of fisheries

The United States Fish and Wildlife Service (USFWS) recognizes that the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO) have the principal management responsibility for fishery resources on the Warm Springs Reservation. The Service and the Tribe have a Memorandum of Understanding and an agreement that the operation of the hatchery is to be compatible with and compliment the Tribe's fishery management goals.

1.4) Funding source, staffing level, and annual hatchery program operational costs.

The Warm Springs NFH is fully funded by the USFWS. The hatchery has a staff of six full time employees and has an annual operating budget of $538,000.

1.5) Location(s) of hatchery and associated facilities.

Warm Springs National Fish Hatchery is located at Rkm 16 of the Warm Springs River, within the Warm Springs Indian Reservation. The Warm Springs River enters the Deschutes River at Rkm 135, which in turn enters the Columbia River at Rkm 329. The hatchery site lies in Section 24, Township 8 South, Range 12 East, Willamette Meridian, Oregon. Shitike Creek enters the Deschutes River at Rkm 155 after flowing approximately 61 km from its headwaters near Mt. Jefferson.

1.6) Type of program.

Integrated Harvest

1.7) Purpose (Goal) of program.

The goals of the Warm Springs National Fish Hatchery (NFH) spring Chinook program are as follows:

1.) Augment wild fish runs in the Warm Springs River in order to provide a sustainable harvest of hatchery spring Chinook salmon for the CTWSRO.
2.) Restore spring Chinook salmon populations in Shitike Creek.
3.) Research techniques for integrating wild and hatchery fish in a way that maintains the biological and genetic characteristics of fish populations in both the hatchery and stream environments.

1.8) Justification for the program.

In 1959, the USFWS, responding to a request by the CTWSRO, began investigating salmon and steelhead enhancement possibilities on Warm Springs Reservation waters. In 1966 Congress authorized the construction of Warm Springs National Fish Hatchery (NFH) in order to enhance anadromous fish runs in Reservation waters and meet the future needs of the resource as well as those of the Tribe. Full production at the hatchery began in 1978. The USFWS and the CTWSRO have cooperatively managed the Warm Springs NFH in a manner that will provide harvest opportunities for hatchery spring Chinook salmon while protecting wild fish populations in the subbasin.

1.9) List of program "Performance Standards".

See Section 1.10

1.10) List of program "Performance Indicators"

Benefits **Performance Standards**	**Performance Indicators**	**Monitoring and Evaluation**
1) Life history characteristics of wild and hatchery fish do not significantly diverge.	Age composition, body size, sex ratio, juvenile migration timing, adult run timing, and spawn timing of wild and hatchery fish are similar.	A subsample of wild and hatchery fish are biosampled in order to collect length, age, sex, and coded-wire tag information for adult fish. The USFWS operates a fish barrier dam and adult fish ladder adjacent to the fish hatchery on the Warm Springs River. Approximately 10% of the wild run and 40% of the hatchery run are sampled at the hatchery. The CTWSRO operates a migrant traps downstream of the hatchery on the Warm Springs River and near the mouth of Shitike Creek that monitor juvenile outmigration timing of wild and hatchery fish.
2) Broodstock collection methods maintain the run timing of wild and hatchery spring Chinook salmon.	Adults collected for broodstock are collected proportionately throughout the run based on wild stock run timing.	Run timing of wild spring Chinook salmon is monitored at the hatchery fish ladder. Broodstock for the hatchery program are collected based on historical run timing averages of the wild run.
3) Produce spring Chinook salmon for harvest in treaty and non-treaty fisheries (U.S. v Oregon).	Contribution of Warm Springs NFH spring Chinook salmon to fisheries in the Deschutes and Warm Springs rivers.	Creel surveys conducted by the CTWSRO and the Oregon Department of Fish and Wildlife (ODFW), coded-wire tag recoveries, and hatchery returns are used to estimate the contribution of Warm Springs NFH spring Chinook salmon to various fisheries.
4) Surplus hatchery spring Chinook salmon are available for outplanting in underseeded habitat on the Warm Springs Reservation.	An average of 200 adult Warm Springs NFH spring Chinook salmon are outplanted into Shitike Creek annually. Outplanting was initiated in 2001.	Adults are selected for outplanting in Shitike Creek at spawn time in the hatchery. Redd surveys, radio-telemetry, genetic surveys, and juvenile monitoring will be used to evaluate the contribution of Warm Spring NFH spring Chinook salmon to natural production in Shitike Creek.

Benefits **Performance Standards**	**Performance Indicators**	**Monitoring and Evaluation**
5) Maximize survival of hatchery spring Chinook salmon at all life stages using disease control and disease prevention techniques.	Hatchery operations comply with USFWS Fish Health Policy and Implementation Guidelines as well as the Integrated Hatchery Operation Team's fish policy.	Specialists from the Lower Columbia River Fish Health Center (LCRFHC) will inspect adult broodstock yearly and monitor juvenile fish on a monthly basis to assess health and detect potential disease problems. As necessary, the LCRFHC will recommend remedial or preventative measures to prevent or treat disease, with administration of therapeutic and prophylactic treatments as deemed necessary.
6) Release healthy, functional smolts from Warm Springs NFH.	Annually release up to 750,000 marked smolts from Warm Springs NFH.	Three to six weeks prior to release or transfer, 60 fish from each lot will be given a health exam by fish health specialists from the LCRFHC. All juvenile fish at the hatchery are externally marked and coded-wire tagged (CWT) prior to release. Juvenile fish are sampled by the USFWS for mark quality and tag retention prior to release. The tag retention goal at release is a minimum of 95%.
7) Juvenile releases from Warm Springs NFH survive and return to the hatchery in sufficient numbers to sustain the hatchery program.	The adult production goal from the 750,000 smolts released from Warm Springs NFH is at least 2,250 adults returning to the mouth of the Deschutes River. The production goal allows for a harvest in the Deschutes River and a broodstock collection goal of 630 hatchery adults at Warm Springs NFH.	Smolt to adult survival rates are estimated for each brood year. Creel surveys conducted by CTWSRO and ODFW sample fish caught in fisheries in the Deschutes River. A subsample of hatchery spring Chinook salmon returning to the hatchery are biosampled. Coded-wire tag recoveries are used to estimate the age structure of returning fish.
8) Fully seed available spring Chinook salmon habitat above Warm Springs NFH.	Maintain a minimum escapement goal for wild spring Chinook salmon above Warm Springs NFH of 1,300 adults (60 cm or greater).	Wild spring Chinook salmon abundance is monitored as fish pass through the fish ladder at Warm Springs NFH. The CTWSRO and USFWS will conduct redd surveys in order to estimate spawning abundance.

Benefits **Performance Standards**	**Performance Indicators**	**Monitoring and Evaluation**
9) Maintain the genetic characteristics and stock integrity of wild summer steelhead in the Warm Springs River above Warm Springs NFH.	Intentionally pass only wild (unmarked) steelhead above the barrier dam at Warm Springs NFH.	During the steelhead migration period all fish are sorted by hand. All hatchery steelhead, identified as having missing or deformed fins, are killed at the hatchery and distributed to the CTWSRO. All wild steelhead are passed upstream. The disposition of each fish handled is recorded in fish removal database files maintained by the USFWS Columbia River Fisheries Program Office.
10) Maintain the genetic characteristics and stock integrity of indigenous fish populations in the Warm Springs River.	Only known indigenous fish species will be intentionally passed above the barrier dam at Warm Springs NFH.	Fish passed upstream are monitored either manually or through a video-monitor system.
11) Warm Springs NFH enhances stream enrichment opportunities in the Warm Springs River.	Carcasses from hatchery broodstock are available for outplanting into the Warm Springs River after spawning.	All carcasses are screened by the fish health center for disease prior to being outplanted into the stream. Carcasses are treated (by evisceration and heat-baking) to prevent potential disease transmission.
12) Design and implement projects to improve the quality of fish production at Warm Springs NFH.	Projects are identified, reviewed, and implemented that will increase survival of program fish while minimizing impacts on wild populations.	Monitoring programs will be incorporated into project designs. Examples of project designs include diet studies, rearing density studies, and rearing environment projects.
13) Effectively communicate with other salmon producers, managers, and the public in the Columbia River Basin.	A yearly meeting with all cooperators and policy level personnel will be held annually in March. Quarterly meetings with the hatchery evaluation team will include hatchery, management, fish health, and tribal representatives.	Effectively communicate with other salmon producers, managers, and the public in the Columbia River Basin.

Risks **Performance Standards**	**Performance Indicators**	**Monitoring and Evaluation**
1) Hatchery operations comply with ESA responsibilities.	Hatchery conducts Section 7 consultations and completes an HGMP. Section 10 permits are issued when applicable.	Refer to M&E Section in this document.
2) Hatchery operations comply with water quality standards.	Hatchery meets the requirements of the National Pollution Discharge Elimination Permit.	Environmental monitoring of total suspended solids, settleable solids, in-hatchery water temperatures, in hatchery dissolved oxygen, nitrogen, ammonia, and pH is conducted annually at the hatchery.
3) Handling of wild spring Chinook salmon is minimized.	An automated fish passage system is used that passively separates coded-wire tagged hatchery spring Chinook from wild fish. The minimum operating standards for the system are removal of 95% of the fish with coded-wire tags and 95% accuracy in counting upstream-bound fish.	Trapping efficiency is evaluated on a regular basis. During efficiency testing upstream bound fish will be held overnight and then manually examined for fin clips and the presence of coded-wire tags. Video monitoring is used to estimate wild fish passage above the hatchery.
4) Harvest of hatchery produced fish minimizes impacts to wild fish populations.	Number of non-target or wild fish caught in tribal and non-tribal fisheries.	The CTWSRO and USFWS formulate a pre-season run prediction for Warm Springs River stocks returning to the Deschutes River. The CTWSRO and ODFW co-manage and monitor the fishery in order to ensure that impacts to wild fish are minimized.
5) Juvenile hatchery releases minimize interactions with wild fish species.	a) All juvenile releases will be at Warm Springs NFH except to meet CTWSRO requests. b) Juvenile releases do not negatively impact wild populations in the Warm Springs River and Deschutes River.	A juvenile trap located downstream of Warm Springs NFH monitors the outmigration of hatchery and wild fish. Juvenile releases may also be monitored using radio telemetry, PIT tagging, snorkeling, trapping, or other techniques.
6) Straying of hatchery fish is minimized.	Recovery of Warm Springs NFH produced fish in non-target watersheds. Stray hatchery steelhead are collected at Warm Springs NFH (see Benefit 9).	Coded-wire tag recoveries throughout the Columbia basin are recorded and summarized in order to estimate the amount of straying of Warm Springs NFH spring Chinook salmon.
7) The water intake system minimizes impacts to wild fish populations.	Water intake screens are replaced in order to meet NMFS Hatchery Biological Opinion criteria.	Screens are monitored by hatchery personnel on a regular basis.

Risks **Performance Standards**	**Performance Indicators**	**Monitoring and Evaluation**
8) Minimize disease risk to wild fish.	Hatchery operations comply with USFWS Fish Health Policy and Implementation Guidelines as well as the Integrated Hatchery Operation Team's fish policy. The USFWS wild fish health survey protocols are followed.	Juvenile fish health is monitored on at least a monthly basis at the hatchery in order to detect potential disease problems. A fish health specialist will examine affected fish and make recommendations on remedial or preventative measures. Therapeutic and prophylactic treatments will be administered upon consultation with the fish health specialist and in accordance with USFWS and the Integrated Hatchery Operation Team's policies. Wild fish used in the broodstock are checked for disease. Wild fish juveniles in the stream are periodically checked, as identified in the hatchery operations plan.

1.11) Expected size of program.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

The annual broodstock collection goal is a maximum of 630 adult spring Chinook salmon. The goal is to have, on a 10 year average, 10% of the hatchery broodstock be of wild fish origin.

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location

Life Stage	Release Location	Annual Release Level
Eyed Eggs	-	-
Unfed Fry	-	-
Fry	-	-
Fingerling	Fall volitional release at Warm Springs NFH	75,000[A]
Yearling	On site release at Warm Springs NFH	750,000
Adult	Adult outplanting into Shitike Creek	200

[A]Fall volitional release is estimated to be 10% of the total number of fish in the ponds. The 10% estimate is based on smolt trap estimates made during the first year of the volitional release program as well as by estimates from the hatchery on pond density and feed use. Additional mark–recapture techniques are being investigated.

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

Table 1.12a. Comparison of survival at different life stages for wild and hatchery spring Chinook salmon from the Warm Springs River, 1985-1996 broodyears (Olson and Spateholts 2001).

	Hatchery Stock			Wild Stock		
Brood Year	**Egg to Juvenile (%)**	**Juvenile to Adult (%)**	**Recruit per Spawner**	**Egg to Juvenile (%)**	**Juvenile to Adult (%)**	**Recruit per Spawner**
1985	55.33	.54	4.53	7.31	3.01	3.49
1986	87.14	.28	3.2	8.27	3.19	3.57
1987	84.1	.13	1.2	7.47	1.46	1.47
1988	86.94	.18	1.79	9.88	1.78	2.65
1989	92.93	.02	.21	7.59	.69	.82
1990	68.94	.005	.04	7.29	.40	.52
1991	81.54	.02	.22	5.4	.37	.28
1992	88.95	.16	1.58	13.66	2.57	4.11
1993	98.46	.29	4.1	8.76	2.68	3.55
1994	85.71	.15	1.94	13.79	.46	.99
1995	83.51	.43	7.3	NA	NA	4.54
1996	93.45	1.27	14.35	18.48	2.27	6.09
Mean	83.92	.29	3.37	9.81	1.72	2.67

Table 1.12b. Number of wild and hatchery spring Chinook salmon passed upstream of or held at Warm Springs NFH. Wild fish to the hatchery includes mortalities and fish used for broodstock; hatchery fish to the hatchery includes fish used for broodstock and surplus fish (CRiS Database 3/18/02).

Year	Wild Spring Chinook Upstream	Wild Spring Chinook to Hatchery	Hatchery Spring Chinook Upstream	Hatchery Spring Chinook to Hatchery
1990	1767	5	0	1390
1991	816	1	0	634
1992	973	89	0	766
1993	534	4	0	308
1994	435	0	0	62
1995	235	2	0	289
1996	1245	42	0	734
1997	867	3	113	922
1998	271	0	21	624
1999	492	2	32	2676
2000	2630	73	285	6300
2001	2193	59	303	4163

The number of wild spring Chinook held at Warm Springs NFH for broodstock is based on a sliding scale of the total expected return (see Section 6.2.3). The number of hatchery fish passed above the hatchery is not to exceed 10% of the wild run.

1.13) Date program started (years in operation), or is expected to start.

Full production at Warm Springs NFH began in 1978.

1.14) Expected duration of program.

The program is ongoing.

1.15) Watersheds targeted by program.

Warms Springs River, Shitike Creek, and Deschutes River subbasins.

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

1.16.1) Brief Overview of Key Issues

Integrated Hatchery Management. Warm Springs National Fish Hatchery (NFH) is a model for an integrated brood stock program, a model for cooperative management between the Confederated Tribes of the Warm Springs Reservation of Oregon and the U.S. Fish and Wildlife Service (Service), and a model for adaptive management based on its monitoring and evaluation program. Warm Springs NFH is 100% funded through the Service.

Hatchery Intake Screens. New hatchery water supply intake screens will be installed in 2004 to meet NOAA Fisheries and Service screen specifications.

Marking. All operations, including marking at Warm Springs NFH are agreed to by The Confederated Tribes of the Warm Springs Reservation of Oregon and the U.S. Fish and Wildlife Service, as outlined in our 2002-2006 five year hatchery operations plan. This plan is negotiated and updated every five years, largely based on the extensive monitoring and evaluation program built into hatchery operations.

Juvenile Salmon Distribution and Production Numbers. Juvenile salmon are released from the hatchery in the fall as subyearling fish and in the spring as yearling fish. Approximately 10% of the total production is released during the fall period. Both release strategies are being investigated to determine maximum hatchery performance for providing fish to the fishery, to mimic wild fish behavior and life history traits, and to minimize impact to wild fish.

Over the years, staff at Warm Springs NFH have reduced the size at release in order to improve fish health, survival, and to mimic wild fish characteristics in the hatchery population. These changes are monitored for effects on fish health, survival, run timing, and age/size at return.

"NATURES" rearing is the practice of employing techniques such as the addition of substrate, coloration, and cover to rearing units in order to mimic natural environs. Shade cloth was placed over ponds in 2001 to provide protection from the sun. In 2003, ten of 30 production ponds were coated with Lifelast[4] polyurethane and colored to approximate the Warm Springs River substrate. These naturally-colored ponds will be compared to standard raceways to compare survival, fish health, and skin coloration of fish. Future experiments are planned to investigate growth rates, natural diet supplements, and hatchery rearing temperatures to match natural rearing area temperature profiles. Predator training may also be investigated.

Other on-going experiments involve varied rearing density, medicated feeding of

erythromycin, and in-pond baffle structures.

Ecological Interactions between Hatchery and Wild Fish. Projects are underway to investigate ecological interactions between hatchery and wild fish within waters of the Warm Springs Indian Reservation and Deschutes River (refer to Section 11, M&E and Section 12, Research). Results from these investigations will be used to modify hatchery operations to lessen impact on native fish and the aquatic environment, as necessary.

Other Acceptable Stocks. If brood stock numbers are insufficient to meet hatchery production objectives, the hatchery will rear fewer fish. In case of a natural or man-made disaster, Round Butte stock from the Deschutes River would be acceptable for use at this facility. In the case that fish are brought in from Round Butte hatchery, fish would be differentially marked to externally identify them upon return for brood stock management.

Surplus Adult Salmon Distribution. In most years, more fish return to the hatchery than are needed for brood stock. Most of these surplus fish are still in very good condition and are distributed to the Confederated Tribes for ceremonial and subsistence use. Fish not suitable for food are typically buried. Adult spring Chinook held for brood stock must be treated (injected) with erythromycin to control bacterial kidney disease infection. Erythromycin has not been cleared for use on food fish by the Federal Drug Administration, therefore, adult fish previously injected with erythromycin cannot be used for human consumption. Prespawn mortalities are unfit for human consumption and, in accordance with the Pacific Northwest Fish Health Protection Committee's draft Salmon and Steelhead Carcass Distribution Protocols, cannot be used for stream enrichment outplants and must be buried on site as well. Surplus fish or spawned carcasses are used for stream enrichment. When surplus adults are used for nutrient outplanting, the fish are individually screened and decapitated/eviscerated to minimize concerns of disease transmission.

Brood Stock Management, Fish Passage, and Ladder Management. As discussed in the hatchery operations plan, up to 10% of the upstream naturally spawning population are hatchery adults spawning naturally in the Warm Springs River. Over a ten-year period, on average, 10% of the hatchery brood stock is to include wild fish. To address these objectives, a sliding-scale for incorporating wild fish into the brood stock was established (Table 6.2.3). The take of wild fish for hatchery brood stock never exceeds 5% of the total wild population in any particular year.

A volitional passage system was installed in 1996 to assist with brood stock management and reduce handling on wild fish passed upstream. The passage system includes a magnetic tag detection gate to separate tagged hatchery and non-tagged wild fish as well as an underwater video to monitor fish passed upstream. The passage system is still being modified and evaluated. The passage system depends on all hatchery fish being adipose fin clipped and coded-wire tagged.

Stock Transfers to Other Watersheds. Approximately 200 adult spring Chinook

salmon have been outplanted as live fish from Warm Springs NFH to another Reservation stream, Shitike Creek, since the year 2000. The outplanting supplementation program is being evaluated. Surplus adults and/or eggs are also provided to Round Butte hatchery as requested and when available. A new egg isolation building was built in 2003 to assist with potential restoration efforts in other watersheds.

1.16.2) Potential Alternatives to the Current Program

Dam Removal. Mainstem Columbia River dam removal to restore habitat has been considered but is not currently regarded as a realistic alternative. Refer to the Federal Columbia River Power System Biological Opinion on the subject.

Removal of the Pelton Dam complex on the Deschutes River to restore habitat has been considered but is also not currently regarded as a realistic alternative. Under FERC re-licensing, the Pelton Dam complex may be operated in a manner to aid in the re-introduction of spring Chinook salmon and steelhead in the Metolius River. Although currently not planned, Warm Springs NFH may help in this re-introduction effort.

Marking. The Service has not made any unilateral decisions on marking but has undertaken actions to comply with ESA Biological Opinions. The Service will continue to coordinate actions with the states and tribes through U.S. v Oregon and NOAA Fisheries to comply with ESA actions and coordinate with the Pacific States Marine Fisheries Commission mark committee. In addition, the federal agencies are beginning discussion of a comprehensive marking strategy for the Columbia River Basin as identified by Action 174-1in the Federal Columbia River Power System Biological Opinion. The federal agencies (NOAA Fisheries lead) are meeting with the states and tribes to begin this effort.

This comprehensive marking plan should:
a) improve our ability to assess and monitor the status of naturally-producing (especially ESA listed) populations
b) monitor and evaluate hatchery programs, including hatchery reforms and stray rates
c) maintain critical harvest management and stock assessment information
d) monitor mark-selective fishery regimes established by the states
e) improve regional and watershed based marking decisions
f) be consistent with recovery plan goals
g) be coordinated through U.S. v Oregon, Pacific States Marine Fisheries Commission and U.S. - Canada forums

Other Stocks. Warm Springs stock spring Chinook salmon in the Warm Springs River has proved successful in returning adults to the Warm Springs and Deschutes rivers with minimal straying to other watersheds. Introducing another stock of spring Chinook salmon is not proposed by any agency or group.

Stock Transfers to Other Watersheds. Future plans for using Warm Springs stock in another watershed are the responsibility of the agency proposing the transfer. The Service is unaware of any plans for transferring fish from Warm Springs outside of the Deschutes River at this time. Within the Deschutes River, the tribe has on occasion expressed interest in developing a terminal fishery at the mouth of the White River, near Sherars Falls. Also there has been some discussion in having Warm Springs NFH assist with re-introduction of spring Chinook salmon into the Metolius River, above Pelton Dam. A new egg isolation building, built in 2003, could assist with potential restoration efforts in these other watersheds.

Disinfection, Chilling, and Water Re-Use Infrastructure. An advance engineering plan has been drafted for development of an ozone treatment, water chilling, and re-use system for Warm Springs NFH. This infrastructure is needed for use during the months of June through September to improve fish health and chill the summer hatchery rearing temperatures to match natural rearing areas temperature profiles at that time.

1.16.3) Potential Reforms and Investments[1]

- Stock Transfers / Supplementation / Terminal Fisheries $$
- Ozone, Chilling, Re-Use Infrastructure $$$$$
- Ozone, Chilling, Re-Use Annual O&M $$$

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS.

2.1) List all ESA permits or authorizations in hand for the hatchery program.

NMFS Biological Opinion on Artificial Propagation in the Columbia River Basin 1999.

2.2) Provide descriptions, status, and projected take actions and levels for ESA-listed natural populations in the target area.

Steelhead (*Oncorhynchus mykiss*), Mid-Columbia ESU, Threatened

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1 For reference:
$ <$50,000
$$ $50,000 to <$100,000
$$$ $100,000 to <$500,000
$$$$ $500,000 to <$1,000,000
$$$$$ $1,000,000 to <$5,000,000
$$$$$$ >$5,000,000

2.2.1) Description of ESA-listed salmonid population(s) affected by the program.

- **Identify the ESA-listed population(s) that will be directly affected by the program.**

The Warm Springs NFH spring Chinook salmon program uses hatchery and wild Warm Springs River spring Chinook salmon in its broodstock program. Warm Springs River spring Chinook salmon are not listed as a threatened or endangered species at this time. No listed species are expected to be directly affected by the spring Chinook salmon program.

- Identify the ESA-listed population(s) that may be incidentally affected by the program.

Listed populations that may be incidentally affected by the spring Chinook salmon program include species utilizing habitat in the Warm Springs River, Shitike Creek, Deschutes River, and the Columbia River downstream of the confluence of the Deschutes River. Of particular concern to the Warm Springs NFH is the population of threatened summer steelhead (*Oncorhynchus mykiss*). Summer steelhead in the Warm Springs River and the Deschutes River subbasin, a component of the Middle Columbia River Evolutionary Significant Unit, were listed as a threatened species by the National Marine Fisheries Service in 1999. The life history characteristics of Warm Springs River summer steelhead are typical of Middle Columbia steelhead. Adult steelhead migrate from the ocean, up the Columbia River, and begin entering the Deschutes River in June. Most adults destined to spawn in the Warm Springs River over-winter in the mainstem of the Deschutes River and begin their spawning migration by entering the Warm Springs River in mid-February. The peak migration past Warm Springs NFH typically occurs in mid-April and is completed by late May (CRiS Database 7/11/02.). Steelhead may begin spawning soon after they enter the Warm Springs River, with spawning taking place from late February to early June. Spawning in the Warm Springs River subbasin primarily occurs in the upper sections of the river above Warm Springs NFH, and in tributaries such as Mill Creek, Beaver Creek, and Badger Creek (Cates 1992).

Depending on the time of spawning and water temperatures, fry emerge from the gravel in spring or early summer. Juvenile steelhead in the Warm Springs River exhibit two life history strategies. Some juvenile steelhead rear in the Warm Springs River for one to three years until they begin the smolting process and migrate to the ocean. Another component of the juvenile population migrates out of the Warm Springs River as presmolts and continues to rear in the Deschutes River for one to three years before smolting and migrating to the ocean. The outmigration of juvenile steelhead from the Warm Springs River occurs during the higher spring flows, typically from March through June. A smaller outmigration of primarily presmolt juvenile steelhead occurs in the fall (Cates 1992).

Shitike Creek, a tributary of the Deschutes River located on the Warm Springs Reservation, also supports a population of summer steelhead. The life history characteristics of steelhead in Shitike Creek are thought to be similar to those in the Warms Springs River, with adult steelhead entering Shitike Creek in the early spring and spawning taking place shortly after entrance into the creek. The primary spawning area in Shitike Creek is thought to be below Peters Pasture (RM 25). Juvenile steelhead rear in the lower sections of the creek or emigrate to the Deschutes River for rearing. The CTWSRO operates an adult weir and a rotary screw trap near the mouth of Shitike Creek in order to gather life history information on steelhead, bull trout, and spring Chinook salmon. Steelhead redd surveys are also conducted by CTWSRO staff in late April or early May.

2.2.2) Status of ESA-listed population(s) affected by the program.

Table 2.2. Number of adult summer steelhead counted at the fish ladder at Warm Springs NFH by run year. Hatchery steelhead (missing or deformed fins) are considered to be strays and are killed at the hatchery (CRiS Database 3/18/02).

Year	Summer Steelhead		
	Wild	Stray Hatchery	Total
1989	385	204	589
1990	339	182	521
1991	165	129	294
1992	280	403	683
1993	79	109	188
1994	135	147	282
1995	95	101	196
1996	85	173	258
1997	243	349	592
1998	214	380	594
1999	96	80	176
2000	319	417	736
2001	503	319	822

2.2.3) Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take

Incidental take of summer steelhead could occur through activities associated with the Warm Springs NFH adult collection facility. A fish barrier dam, adjacent to the hatchery, blocks upstream passage of all fish and directs them into a fish ladder located at the hatchery. Upon entering the fish ladder, fish are either directed into holding ponds or passed upstream above the barrier dam. An automated fish passage system is used during the spring Chinook salmon migration period, generally from May through the end of September. The automated passage system is designed to minimize handling of wild fish by passively separating returning hatchery spring Chinook salmon, identified by the presence of coded-wire tags, from wild fish. The passage system uses a 15-foot long denil steeppass fishway with a coded-wire tag tube detector and gate. As fish swim through the fishway and tube detector, coded-wire tagged fish are detected and a gate opens that shunts them into a holding pond. Non coded-wire tagged fish do not trigger the gate and are able to continue migrating up through the fish ladder and upstream of the barrier dam. A video system records non-coded wire tagged fish as they pass upstream of the hatchery. The video system allows hatchery personnel to monitor the number, species, and origin of fish passing upstream. During operation of the automated passage system wild fish are not handled by hatchery personnel, thereby reducing the potential take of listed species. Migration delays as fish find their way into the fish ladder and through the passage system, rejection of the fish ladder resulting in displaced spawning, and injuries suffered as adults try to jump the barrier dam are potential incidental takes associated with the barrier dam. The actual level of incidental take associated with the barrier dam is unknown at this time. Based on observations by hatchery personnel of fish movements through the barrier dam and passage system, the level of take is assumed to be low (Mike Paiya, USFWS Warm Springs NFH, personal communication).

The automated passage system is only used during the spring Chinook salmon migration period, generally from April 15 to September 30. The proper functioning of the passage system relies on 100% coded-wire tagging of hatchery fish, with all non coded-wire tagged fish passed upstream. All spring Chinook salmon juveniles released from Warm Springs NFH are coded-wire tagged (the tag retention goal is 95%) but stray hatchery fish from hatcheries outside the subbasin may not be coded-wire tagged. The Warm Springs River, and the Deschutes River subbasin in general, has a high incidence of stray hatchery steelhead (Olson and Pastor 1998). In order to preserve the genetic integrity of wild steelhead in the Warm Springs River, it is the policy of Warm Springs NFH to pass only wild (unmarked) steelhead above the barrier dam. In order to accomplish this goal, the automated fish passage system is not used until the steelhead migration has ended, usually sometime in late April. During the steelhead migration period fish find their way into the fish ladder and into a holding pond. Hatchery personnel then hand sort the fish. Fish are sedated using CO_2, sorted, measured, and then either passed upstream or collected for the hatchery. All wild summer steelhead, bull trout, and other indigenous

fish species are passed upstream. Stray hatchery steelhead, identified as having missing or deformed fins, are held in holding ponds, killed, and distributed to the CTWSRO.

Incidental take of listed species may occur during the manual sorting of fish in the fish ladder at Warm Springs NFH. Potential take could occur as a result of delay in migration timing, stress associated with handling, or misidentification of wild and hatchery steelhead. Hatchery personnel attempt to minimize handling stress on fish by following the appropriate fish handling guidelines. Direct take on listed species as a result of the fish barrier dam, fish ladder, and hatchery sorting procedures has been minimal. Three unmarked adult steelhead were accidentally killed in 1998. No other mortality of unmarked adult steelhead at the hatchery has been recorded since 1995 (CRiS Database 3/18/02).

Monitoring activities associated with the Warm Springs spring Chinook program also have the potential for incidental take of listed steelhead and bull trout. A rotary screw trap, located at approximately Rkm 5 of the Warm Springs River, is operated by the CTWSRO in order to gather outmigration timing and population estimates for juvenile spring Chinook salmon. The trap is typically operated from mid-March through mid-November. Based on catch data during this time period, it appears that juvenile wild and hatchery spring Chinook may be migrating out of the Warm Springs River during the winter months (Bob Spateholts, personal communication). The CTWSRO anticipates extending the time of trap operation of the Warm Springs rotary trap to a year-round trapping period in the fall of 2003. The rotary screw trap will be operated as long as stream flows are appropriate for trapping, i.e. flows are neither too low nor too high for efficient trapping. Juvenile spring Chinook salmon collected at the trap are anesthetized with MS-222, measured, weighed, and a subsample is marked and released upstream for mark-recapture population estimates. Some juvenile spring Chinook salmon may be implanted with radio-tags in order to monitor their migration behavior in the Deschutes River (See Section 12). Listed juvenile steelhead and bull trout are also collected at the trap. Juvenile steelhead and juvenile resident trout are visually indistinguishable and are summarized together for monitoring purposes. Juvenile steelhead will be handled, measured, and marked using the same procedures as for spring Chinook salmon. For an estimate of the number of steelhead trapped see Take Table 1. The probability of capture for juvenile bull trout in the trap is low, with fewer than ten bull trout trapped per year (Bob Spateholts, CTWSRO Warm Springs, personal communication). If juvenile bull trout are collected at the trap they will be weighed, measured, marked, and released upstream.

Incidental take of juvenile summer steelhead may occur through stress associated with the handling and marking procedures. Procedures associated with the juvenile trap are designed to minimize stress and potential take. The traps are checked regularly in order to minimize the amount of time fish are held at the trap. The amount of time fish are under anesthetic is carefully monitored and fish are allowed sufficient time to recover before being released back into the river. The potential for direct take of listed species at the traps as a result of trap malfunction or predator intrusion is considered to be low. The CTWSRO have observed mink predation on fish caught in the screw trap (Bob

Spateholts, CTWSRO Warm Springs, personal communication). If recurring predators become a problem, live traps may be set to relocate the predators away from the trap site. During periods of high flows debris may clog the rotary screw mechanism or live box, possibly resulting in descaling or wounding of fish in the trap. Daily monitoring of the trap is expected to minimize take associated with trap malfunction or predator intrusion. If high flows are anticipated, the trap is raised in order to reduce the likelihood of trap malfunction. The traps are also deactivated when water temperatures exceed 20 degrees Celsius or if there are visible signs of stress in fish in the live box. Estimated take levels for listed steelhead in the Warm Springs River are summarized in Take Table 1.

The USFWS expects to conduct research and monitoring activities at the hatchery and in the stream environment that will focus on the ecological interactions of hatchery and wild fish in the Warm Springs River, Shitike Creek, and Deschutes River. The research program is intended to gather information that will help managers evaluate hatchery practices and reduce impacts of the hatchery program on wild fish populations. Proposed research activities associated with Warm Spring NFH are discussed in detail in Section 12. Sampling of spring Chinook salmon will occur through the normal hatchery and monitoring activities on the Warm Springs River. Incidental take associated with the research program is expected to be minimal. Up to 100 juvenile spring Chinook salmon will be implanted with radio-tags at the rotary screw trap on the Warm Springs River. Other research activities on the Warm Springs River include expanded redd surveys and tissue sampling for genetic pedigree analysis of hatchery spring Chinook salmon at the Warm Springs NFH.

Snorkel surveys will also be conducted by the CTWSRO and the Service in order to monitor population abundance of juvenile fish in the Warm Springs River. During a snorkel survey, temporary block-nets will be placed at the upstream and downstream end of a habitat unit. Snorkelers will then visually observe fish in the unit, recording either microhabitat preference or abundance estimates. Snorkelers will make up to three passes through the habitat unit. Once the snorkelers are finished with their survey the block nets will be removed. Snorkel abundance estimates will be supplemented with mark-recapture estimates in a subsample of the habitat units (approximately three to six units total). For the mark-recapture estimates, fish will be seined out of the unit and placed into water filled buckets/containers. The fish will then be anesthetized with MS-222, counted, measured, and then placed into a bucket containing a mixture of water and Bismark-brown dye. The dye will temporarily (one to three days) dye the fins and body of the fish a light brown color. Once the marked fish have recovered from the anesthetic they will be released back into the habitat unit. The fish will be recaptured either by re-seining or by a snorkel “resight”.

The USFWS and the CTWSRO also anticipate conducting monitoring and research activities on Shitike Creek. Shitike Creek is small tributary of the Deschutes River that is located on the Warm Springs Reservation. Since 2000, the USFWS and the CTWSRO have outplanted Warm Springs NFH adult spring Chinook salmon into Shitike Creek. The objectives of the monitoring and research program are as follows:

1) Evaluate the contribution of outplanted spring Chinook salmon to the natural production in Shitike Creek.
2) Investigate the potential ecological interactions of spring Chinook, bull trout, and summer steelhead in Shitike Creek.

As part of the monitoring program, adult spring Chinook salmon will be sampled at a temporary weir located near the mouth of Shitike Creek. The temporary weir is operated by the CTWSRO as part of a bull trout monitoring program funded by the Bonneville Power Administration. The weir consists of a series of pickets that block migration and both an upstream and downstream live box that hold fish until they are sampled. Adult fish migrating upstream and downstream are trapped in the live boxes and sampled by CTWSRO personnel. Sampling takes place in the morning when water temperatures are at their lowest. Upstream migrating fish will be anesthetized in a large trough containing water and MS-222. Sampling of the upstream migrating fish includes taking length measurements and scale samples. As part of the spring Chinook salmon program, tissue and scale samples will be collected from all upstream migrating spring Chinook salmon. Fish will be allowed to recover from the anesthetic and then be released back into the stream in the direction of their migration. Fish trapped in the downstream live box will not be anesthetized but will be counted and passed over the weir. Water temperatures are monitored on a daily basis, if water temperatures rise above 17 degrees C , pickets in the weir will be removed to allow fish to move upstream and downstream without entering the live boxes. Incidental take of steelhead may occur at the weir as a result of handling stress or delayed migration (Take Table 2).

Starting in 2003, the temporary weir will be operated by the CTWSRO spring Chinook monitoring program. The weir has typically been installed in late April or early May, after the main upstream migration of adult summer steelhead. Starting in 2004, the CTWSRO and the USFWS may install the weir as early as January in order to collect information on steelhead populations in Shitike Creek. Information that may be collected on steelhead include adult population size, the number of stray hatchery steelhead, run-timing, and the genetic make-up of the wild steelhead population. In addition, the USFWS and the CTWSRO may conduct studies on the reproductive success of wild and stray hatchery steelhead in Shitike Creek. Fin-clips, approximately 1cm^2, would be collected from all upstream migrating adult stray hatchery and wild steelhead trapped at the weir. Fin-clips would then be collected from approximately 1000 juvenile steelhead per brood year collected both at the rotary screw trap and from a random sample of juvenile fish in the stream. Using DNA assignment tests and pedigree analyses, the reproductive success of wild and stray hatchery steelhead would be estimated. Operation of the weir from January to April and implementation of the reproductive success study are currently in the proposal stage, the earliest date for implementation would be January of 2004. The operation and sampling protocol at the weir during the earlier time period (January through March) would follow the current protocols. The take estimates in Take Table 2 include take that would occur if the reproductive success study is implemented.

Juvenile sampling of downstream migrating fish occurs at a rotary screw trap located near the mouth of Shitike Creek in the town of Warm Springs. The screw trap is operated when flows are sufficient, typically from March through June and from October through November. Beginning in 2004, the CTWSRO will begin operating the smolt trap in early January in order to determine if juvenile spring Chinook are migrating out during the winter months. The CTWSRO operates the trap as part of the bull trout study and also to gather juvenile population estimates for steelhead and spring Chinook. Procedures for operating the Shitike Creek screw trap are the same as for the Warm Springs River screw trap. The outplanting monitoring program will collect tissue samples (fin clips) from approximately 1000 juvenile spring Chinook salmon captured at the trap. Passive Integrated Transponder (PIT) tags may also be applied to juvenile Chinook salmon. No additional take of listed species is anticipated as a result of the spring Chinook salmon sampling.

The USFWS and the CTWSRO will also conduct snorkel surveys and juvenile sampling in Shitike Creek during July and August. Snorkel surveys will collect observational data on microhabitat preferences, species associations, and species interactions for juvenile salmonids. Snorkel surveys will also be used to estimate abundance of juvenile fish in selected reaches in Shitike Creek. Procedures for estimating abundance in Shitike Creek will be identical to those discussed for the Warm Springs River. Tissue samples from age 0 spring Chinook salmon will be collected during the mark-resight sampling. As part of the proposed steelhead reproductive success evaluation, fin clips may also be collected from juvenile rainbow/steelhead. Incidental take may occur as a result of harassment or stress associated the seining or marking. Samplers will monitor water temperatures and attempt to minimize stress on the fish during the marking procedures. Potential take could also occur if marked fish are more susceptible to predation. The short duration of the mark (one to three days) will help minimize take as a result of increased susceptibility to predation. Take estimates for listed rainbow/steelhead are summarized in Take Table 1 for the Warm Springs River and Take Table 2 for Shitike Creek.

- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.

Direct injury or mortality due to hatchery operations have historically been low. In 1998, three wild adult steelhead were accidentally killed at the hatchery (CRiS Database 7/11/02).

-Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

See take tables (Take Table 1 for estimated take of listed steelhead in the Warm Springs River, Take Table 2 for estimated take of listed steelhead in Shitike Creek).

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

If take levels exceed the projected levels, the USFWS and the CTWSRO will work with the National Marine Fisheries Service to ensure that hatchery operations minimize future take on the listed species.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.

Warm Springs NFH operates in compliance with the ODFW Lower Deschutes River Management Plan, the NPPC Deschutes River Salmon and Steelhead Plan, and the 1999 NMFS Biological Opinion on Columbia River Hatcheries.

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates

This HGMP is consistent with the following agreements, plans, and court orders:

Federal Statute 184
IHOT Standards and Policies
Intra-Service Section 7 Consultation for bull trout
Memorandum of Understanding between the USFWS and the CTWSRO, March 10, 1998
NPPC Deschutes River Salmon and Steelhead Plan
ODFW Lower Deschutes River Management Plan
USFWS and CTWSRO cooperative agreement 2002
U.S. v. Oregon
Wy Kan Ush Me Ka Wit, CRITFC
1999 NMFS Biological Opinion on Columbia River Hatcheries
2002-2006 Hatchery Operation Plan, March 7, 2002

3.3) Relationship to harvest objectives.

Artificial production at Warm Springs NFH is integrated with harvest management in order to provide a sustainable harvest of hatchery spring Chinook salmon while minimizing risks to wild fish populations in the Warm Springs and Deschutes Rivers. All juvenile hatchery spring Chinook salmon released from Warm Springs NFH are externally marked for visual identification. The CTWSRO and the Oregon Department of Fish and Wildlife (ODFW) co-manage harvest in the Deschutes River Subbasin, while harvest in the Columbia River is managed by the parties to U.S. v. Oregon. Harvest management decisions are consistent with the ODFW Lower Deschutes River Fish Subbasin Management Plan (1997). Harvest for Warm Springs River spring Chinook salmon occurs primarily in the Deschutes River and lower Warm Springs River. Wild fish abundance drives fishery management decisions made by the CTWSRO and the ODFW.

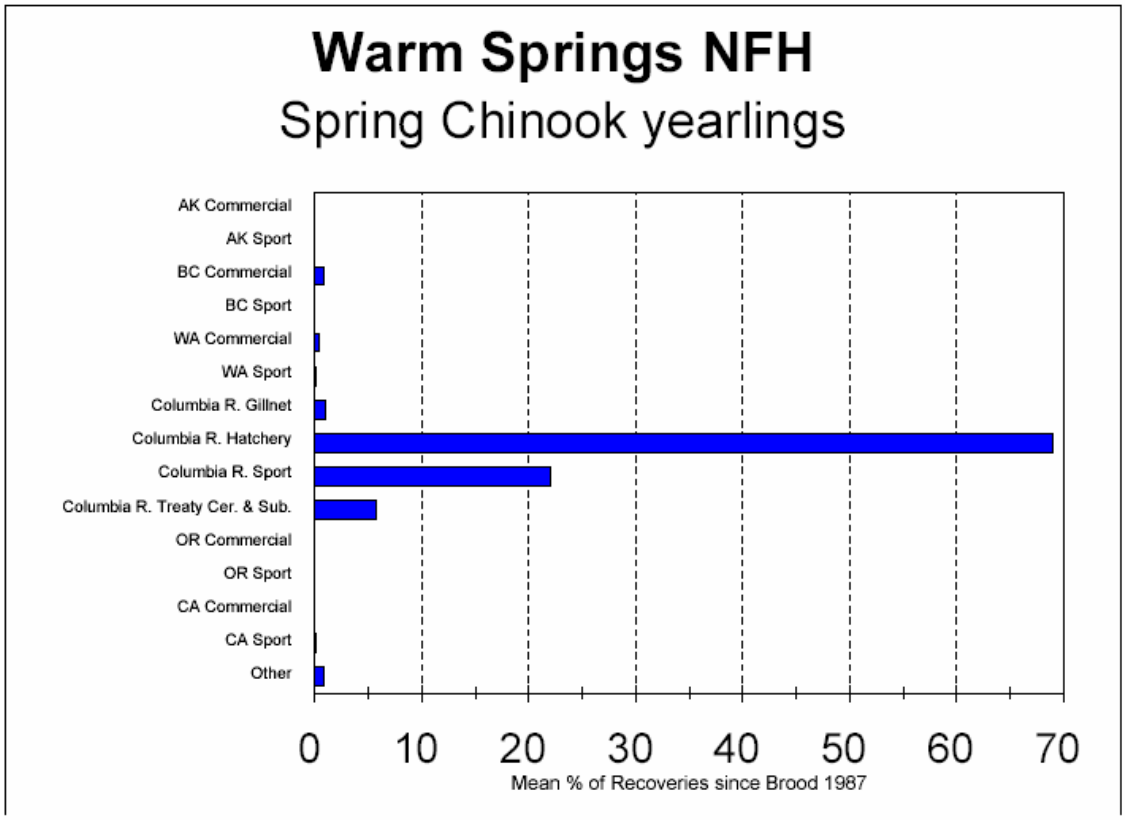
3.3.1) Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

Fisheries benefiting from the Warm Springs NFH spring Chinook program include tribal ceremonial, tribal subsistence, and freshwater sport fisheries. Tribal fisheries also target wild Warm Springs River spring Chinook salmon. The percent contribution by fishery is shown in Graph 3.3.1.

Table 3.3.1. Harvest, total hatchery return, and harvest rate of Warm Springs NFH spring Chinook salmon. Harvest is estimated from coded-wire tag recoveries in tribal and sport fisheries (CRiS Database 7/11/02).

Brood Year	Harvest	Hatchery Return	Total	Harvest Rate
87	376	554	930	40%
88	474	848	1322	36%
89	70	135	205	34%
90	6	26	32	19%
91	9	85	94	10%
92	137	735	872	16%
93	126	887	1013	12%
94	15	559	574	3%
Mean	152	479	630	24%

Graph 3.3.1. Coded Wire Tag recoveries for Warm Springs NFH spring Chinook salmon.



3.4) Relationship to habitat protection and recovery strategies.

Natural production in the Warm Springs River and Deschutes River is limited by the following: water quantity, water quality, consumptive water use, instream water rights, water diversion screening, sedimentation, stream substrate, cover, and barriers to fish passage (ODFW 1997). The CTWSRO are responsible for habitat protection and recovery strategies on the Warm Springs Reservation. Habitat conditions in the Warm Springs River and Shitike Creek are considered to be fair to good. The CTWSRO have implemented various habitat restoration programs including riparian fencing, water diversion modifications, and placement of instream structures.

3.5) Ecological interactions.

1.) Species that could negatively impact the program include the following:

-out of basin stray hatchery summer steelhead,
-stray hatchery spring Chinook salmon,
-northern pikeminnow,
-bull trout
-introduced species such as bass, walleye, and brown trout,
-and avian and mamalian predators.

Negative impacts on the spring Chinook salmon program can occur directly through predation on program fish, or indirectly though competition, genetic mechanisms, or other ecological interactions. Predators such as the northern pikeminnow, bull trout, bass, Caspian tern, and California sea lion may feed on juvenile and adult hatchery salmon in the Columbia River system, reducing the survival rate for program fish. Competition for limited resources from stray hatchery fish could indirectly lead to lower survival rates for program fish.

2.) Fish species that could be negatively impacted by the program include the following:

-listed summer steelhead,
-listed bull trout,
-wild spring Chinook salmon,
-and other species using the Deschutes River subbasin and Columbia River.

Juvenile releases from Warm Springs NFH could have negative impacts on fish species in the Warm Springs, Deschutes, and Columbia rivers. The current production goal is to annually release 750,000 spring Chinook salmon smolts into the Warm Springs River. Warm Springs NFH currently releases juvenile spring Chinook during both a fall and spring release period. Approximately 10% of the hatchery production is volitionally released as sub-yearlings in the fall, from early October to late November. The fall volitional release of age 0+ fish from the hatchery mimics one component of the wild fish juvenile migration pattern from the Warm Springs River. Movement of wild juvenile spring Chinook salmon out of the Warm Springs River is split into a fall and spring migration period (Lindsay et al. 1989 and Olson et al. 1995). The remaining 90% of hatchery fish are released as yearlings in the spring, from late March through April.

The goal of Warm Springs NFH is to release functional smolts that quickly migrate to the ocean. Most fish released in the spring reach the estuary within three to four weeks (Olson et al. 1995). The behavior of fish released in the fall is not clear. Scale analysis of adult returns indicated that most fall-released fish that survived to adulthood over-wintered in freshwater before migrating to the ocean the following spring (Doug Olson, USFWS Vancouver, pers. comm). A pilot study by the United States Geological Survey

(USGS) in 2000 used radio telemetry techniques to investigate the migration behavior of juvenile hatchery spring Chinook salmon released from Warm Springs NFH in the fall. Results of the study showed that 65% of the radio tagged hatchery fish that were released in late October remained in the Deschutes River until the study ended in January. Based on the telemetry data and estimates of the total number of hatchery fish released during the fall period, the USGS estimated that between 19,500 and 48,750 juvenile hatchery spring Chinook from Warm Springs NFH remained in the Deschutes River during the fall of 2000 (Wardell et al. 2002). The USFWS and USGS plan to continue studying the migration behavior of fall-released fish in 2002 (see Section 12).

The impact of the fall release program on the aquatic community in the Warm Springs and Deschutes rivers is not completely understood at this time. The USFWS is developing study designs that will monitor and evaluate the fall release program and investigate potential impacts of the program on fish species in the Deschutes River. The studies are expected to accomplish the following:

1.) Develop a more accurate estimate of the number of fish that are volitionally released from the hatchery in the fall.
2.) Determine the migratory behavior and habitat preference of fall released fish.
3.) Determine whether the Deschutes River can support the fall released fish without adversely impacting the wild fish populations.
4.) Determine whether fall released fish adversely impact the food supply, fish health, competition, or predation in the Deschutes River.

The fall release program is scheduled to continue on a limited basis (approximately 10% of total hatchery production). Fish that are released in the fall, overwinter in the Deschutes River, and survive to spawning may help retain wild fish characteristics in the hatchery program. If, however, the monitoring and evaluation program or related research studies identify potential adverse impacts to wild fish populations, both the USFWS and the CTWSRO will consider modifying the release program in order to minimize these impacts.

Shitike Creek and the Warm Springs River are the only tributaries of the Deschutes River that currently support successful natural spawning of spring Chinook salmon. The density, or redds per mile, of spawning spring Chinook salmon in Shitike Creek has generally been lower than in the Warm Springs River and it is thought that the habitat is underseeded (Lindsay *et al*. 1989). Habitat improvement and fish passage projects have been ongoing in Shitike Creek since the 1980's. A man made barrier blocking the upper reaches of the drainage was removed in 1983 and a natural cascade was removed to improve adult passage. Despite these improvements natural production in the drainage remained at relatively low levels. Indexed redd counts in Shitike Creek from 1978 to 1999 varied from a low of six in 1996 to a high of 33 in 1997 (CTWSRO unpublished data).

In 2000, the CTWSRO and the USFWS initiated an adult spring Chinook salmon outplanting program designed to increase natural production of spring Chinook in Shitike Creek. Adult hatchery spring Chinook salmon returning to the Warm Springs River are trapped at the Warm Springs NFH and are held in holding ponds at the hatchery until late August or early September. Hatchery personnel then sort the adults for hatchery broodstock collection, with some surplus hatchery fish selected for outplanting into Shitike Creek. Outplanted fish are released at various locations within Shitike Creek during early September and are allowed to spawn naturally. The goal of the program is to annually release approximately 200 adult spring Chinook at up to five locations within Shitike Creek. The number of fish released and the locations of release were based on the estimated amount of suitable spawning habitat in selected stream reaches. In 2000, the first year of spring Chinook outplanting, 110 males and 49 females were released into Shitike Creek. Spawning ground surveys for 2000 counted 52 spring Chinook redds, the highest number of redds counted since surveys began in 1978 (CTWSRO unpublished data). The USFWS is conducting a radio telemetry study and a genetic analysis of outplanted spring Chinook salmon in Shitike Creek in order to estimate the spawning success and spawning site selection of outplanted fish (see Section 12).

Most of the natural production of spring Chinook salmon in Shitike Creek during the past 20-30 years has occurred in the lower 10 miles of the stream. Bull trout are thought to spawn and rear in the upper sections of Shitike Creek while summer steelhead spawn and rear in the middle and lower sections (Bob Spateholts, CTWSRO Warm Springs, pers. comm) The outplanting program is expected to increase the natural production of spring Chinook salmon in Shitike Creek by increasing the adult spawning population. While the current level of interspecific competition between Chinook, steelhead, and bull trout in Shitike Creek is not known, the potential for competition would be expected to increase as spring Chinook salmon populations increase and habitat utilization increases. Juvenile spring Chinook salmon may provide a forage base for bull trout and other species in Shitike Creek. If other types of interspecific competition, such as overlap in microhabitat use or antagonistic behavior, exist the outplanting program may have unintended negative impacts on these species. Conversely, differences in microhabitat use by juveniles of different species may indicate a mechanism by which competing species are able to coexist in the same macrohabitat, thereby minimizing potential negative consequences of the outplanting program.

The microhabitat preferences and level of interaction between juvenile spring Chinook salmon and juvenile steelhead in areas of co-occurrence in Shitike Creek is not known. Summer steelhead are thought to inhabit the middle and lower sections of Shitike Creek, areas where relatively high densities of juvenile spring Chinook salmon are found. The USFWS and the CTWSRO anticipate initiating monitoring and evaluation activities that will look at potential impacts of the outplanting program on indigenous fish species in Shitike Creek.

3.) Fish species that could positively impact the program include wild spring Chinook salmon and other salmonid species that naturally spawn in the Warm Springs and

Deschutes rivers. Wild spring Chinook salmon are the source of approximately 10% of the broodstock at Warm Springs NFH. Decaying carcasses of salmonid species may contribute nutrients that increase productivity in the subbasin. Warm Springs NFH, in cooperation with the CTWSRO, distributes the carcasses of hatchery broodstock fish throughout the Warm Spring River in order to increase the nutrient supply. Prior to distribution in the river, carcasses are beheaded and eviscerated to prevent transmission of fish pathogens.

4.) Fish species that could be positively impacted by the program include the following:

-listed summer steelhead,
-listed bull trout,
-other species using the Deschutes River subbasin and Columbia River.

Freshwater and marine species that depend on salmonids as a nutrient and food base could be positively impacted by the program. Many species are known to utilize juvenile and adult salmon as a nutrient food base (Groot and Margolis 1991; McNeil and Himsworth 1980). Pacific salmon carcasses are also important for nutrient input back to freshwater streams (Cederholm et al. 1999). Declines in wild salmonid populations during the last few decades could reduce overall ecosystem productivity. Hatchery production has the potential for playing a role in the population dynamics of predator-prey relationships and community ecology during low productivity and shifting climactic cycles.

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

The water source for the hatchery is the Warm Springs River. All water rights on the Warm Springs River are the property of the CTWSRO. The intake structure and pumps are located at the hatchery site just upstream of the barrier dam. Prior to being pumped, water is passed through a trash rack and traveling screen. In front of the traveling screen is a fish bypass which deposits small fish below the barrier dam. The screens on the intake are 3/16th inch mesh.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

A small number of wild juvenile steelhead or resident rainbow trout, lamprey, and suckers has been observed in the rearing ponds at the hatchery. This indicates that juvenile fish from the Warm Springs River are making it through the intake and into the hatchery. The Integrated Hatchery Operations Team noted that the current 3/16th inch mesh does not meet the 1/10th inch standard for screening facilities (IHOT 1996). The

Warm Springs NFH Implementation Plan (CTWSRO and USFWS 2002) identifies the need to replace the water intake structure to meet NMFS Hatchery Biological Opinion criteria.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

All fish passing upstream are blocked by a barrier dam and are directed to a fish ladder at Warm Springs NFH. All fish must use the fish ladder in order to pass upstream of the hatchery. During the spring Chinook salmon migration period (April 16- September 30), an automated fish passage system is used to pass all wild (unmarked) fish upstream of the barrier dam (see Section 2.2.3 for more details). Fish that are not passed upstream are directed into a catch pond. The catch pond measures 28ft x 8ft, with a water depth of 3ft. Fish are then moved from the catch ponds into holding ponds at the hatchery. Fish are held in the holding ponds until spawning.

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

Approximately 200 hatchery adult spring Chinook salmon are outplanted into Shitike Creek during late August and early September. Staff from the CTWSRO use a tank truck to transport fish from the adult holding ponds to five release sites along Shitike Creek.

Egg Transportation
There is no off-station transport of spring Chinook salmon eggs at the present time.

Fingerling Transportation
There is no off-station transport of spring Chinook salmon fingerlings at the present time.

Smolt Transportation
There is no off-station transport of spring Chinook salmon smolts occurring at the present time.

There has been transport of eggs, fingerlings, and smolts to other sites for research purposes by USGS in the past. Emergency conditions at the hatchery may result in the temporary transfer of eggs or juveniles to other hatcheries (see Section 5.7).

5.3) Broodstock holding and spawning facilities.

Two oval shaped ponds, each 50ft x 26ft with approximately a 6ft water depth are used to hold broodstock until spawning. Each pond is fully enclosed at the top and sides above the water surface by nylon netting. The netting prevents fish from jumping out of the holding ponds and prevents predators from gaining entry. The ponds are plumbed to supply chilled water as summer water temperatures increase.

5.4) Incubation facilities.

Incubation facilities consist of 16 stacks of 15 Heath incubator trays.

5.5) Rearing facilities.

Rearing facilities at Warm Springs NFH consist of 20 rectangular Burrows ponds measuring 75ft x 16ft with a water depth of 1.7ft, and 20 modified rectangular Burrows ponds measuring 75ft x 8ft with a water depth of 1.7ft.

5.6) Acclimation/release facilities.

All Warm Springs NFH spring Chinook salmon smolts are released onsite at the hatchery. Gates are opened at the end of each raceway that allow fish to leave the hatchery via a pipe that enters the Warm Springs River, just downstream of the adult barrier dam.

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

In March of 1999, a traffic accident on Highway 26 resulted in a spill of diesel fuel into Beaver Creek, a tributary to the Warm Springs River above Warm Springs NFH. Due to concerns about fuel entering the water supply at the hatchery, all of the brood year 1998's smolts were released early. On 4 March approximately 775,000 smolts were released from the hatchery and into the Warm Springs River, this release was approximately four to six weeks earlier than the normal release time at Warm Springs NFH. No direct mortality from the early release was observed. In addition to the early release of BY 1998 smolts, BY 1999 juveniles were transported to Round Butte Hatchery. Round Butte Hatchery is located on the Deschutes River at the base of Round Butte Dam (RM 110), and is operated by the Oregon Department of Fish and Wildlife. Round Butte Hatchery and its satellite (Pelton Ladder) are used for adult collection, egg incubation, and rearing of spring Chinook salmon and summer steelhead. Round Butte Hatchery temporarily held the BY 1999 juveniles until the water supply at WSNFH was tested and found to be safe.

5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

Warm Springs NFH is equipped with backup generators and pumps that provide power in case of power failures. An automated alarm system alerts on-call staff members of potential problems at the hatchery during non-work hours. The hatchery also has a

chemical spill kit and floating booms to contain accidental spills. In extreme situations, fish at WSNFH can be transported to Round Butte hatchery for temporary holding (see Section 5.7).

The LCRFHC manages fish health and disease prevention in accordance with the USFWS Fish Health and IHOT policies and with protocols of ODFW. Any health problems are managed promptly by fish health personnel to limit mortality and reduce disease transmission.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

-Wild Warm Springs River spring Chinook salmon (unlisted)
-Warm Springs NFH spring Chinook salmon
-Round Butte Hatchery spring Chinook salmon (potential use during years of low returns to Warm Springs hatchery).

Round Butte Hatchery spring Chinook salmon are thought to have similar life history characteristics to Warm Springs NFH spring Chinook salmon (Doug Olson, USFWS Vancouver, pers. comm). The original broodstock for Round Butte Hatchery was collected from a trap at Sherars Falls in the lower Deschutes River. It is likely that most fish collected at the falls were Warm Springs River spring Chinook salmon since the Warm Springs River is the major producer of spring Chinook salmon in the Deschutes River subbasin.

6.2) Supporting information.

6.2.1) History.

During the first four years of broodstock collection (1978-1981), 100% of the broodstock was collected from wild Warm Springs River spring Chinook salmon. Since 1981, the majority of broodstock has been of Warm Springs NFH origin. In order to maintain wild characteristics in the hatchery program, the Warm Springs NFH Operation and Implementation Plan 2002-2006 sets a goal of having an average of 10% of the hatchery broodstock of wild origin, based on a sliding scale according to total wild returns (see Section 6.2.3).

6.2.2) Annual size.

The broodstock collection goal is 630 adult spring Chinook salmon.

6.2.3) Past and proposed level of natural fish in broodstock.

Since 1990, the number of wild fish incorporated into the broodstock has ranged from 0 to 59 (see table 7.4.2). The current goal of the hatchery program is to have, on a 10 year average, 10% of the hatchery broodstock of wild fish origin. A sliding scale for wild broodstock retention based on projected wild fish returns will be used.

Table 6.2.3. Sliding scale for using wild spring Chinook salmon in the hatchery broodstock (CTWSRO and USFWS 2002).

Projected Wild Escapement	Wild fish retained for Warm Springs NFH brood	Percent of hatchery brood contributed by wild fish
<800	0	0
800-899	31	5
900-999	38	6
1000-1099	45	7
1100-1199	50	8
1200-1299	57	9
1300-1399	63	10
1400-1499	69	11
1500-1599	76	12
1600-1699	82	13
1700-1799	88	14
1800-1899	95	15
1900-1999	100	16
2000-2099	107	17
2100-2199	113	18
2200-2299	120	19
>2300	126	20

6.2.4) Genetic or ecological differences.

The goal of the Warm Springs NFH spring Chinook salmon program has been to integrate wild and hatchery fish in a way that maintains the biological and genetic characteristics of the fish populations in both the hatchery and stream environments. Monitoring and evaluation of the program has been ongoing since its inception in 1978. Recent evaluation studies indicate that while measurable differences have been detected in some life history characteristics, the hatchery population closely mimics those of the wild population (Olson and Spateholts 2001).

6.2.5) Reasons for choosing.

Wild Warm Springs River spring Chinook salmon are adapted to the physical and biological characteristics of the Warm Springs River.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

No adverse genetic effects to listed summer steelhead or bull trout are expected from the spring Chinook salmon hatchery broodstock selection process.

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Warm Springs NFH collects adult spring Chinook salmon for broodstock.

7.2) Collection or sampling design.

All fish passing upstream are blocked by a barrier dam and are directed to a fish ladder at Warm Springs NFH. During the spring Chinook salmon migration period (April 15-September 30), an automated fish passage system is used to pass all wild, unmarked fish upstream of the barrier (see Section 2.2.3 for more details). All coded-wire tagged fish are shunted into holding ponds. Adult fish are selected for broodstock proportionately throughout the run based on wild stock run timing. The target for broodstock collection is presented on the following page.

Table 7.2. Broodstock collection targets for Warm Springs NFH (CTWSRO and USFWS 2002).

Date	Cumulative Percent of Brood Collected
May 8	12
May 15	24
May 23	45
May 31	67
June 8	77
June 15	86
June 23	89
June 30	91
July 31	93
Aug 25	100

7.3) Identity.

All juvenile Warm Springs NFH spring Chinook salmon are adipose-fin clipped and coded-wire tagged prior to release**.** The USFWS samples juvenile fish for mark quality and tag retention prior to release. The program goal is a minimum tag retention rate of 95%. The automated fish passage system sorts returning hatchery and wild fish based on the presence of coded-wire tags.

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

The Warm Springs NFH Operation and Implementation Plan 2002-2006 sets a broodstock goal of 630 spring Chinook salmon, assuming 90% pre-spawning survival and a return that is 60% female. When the number of returning males is low, the male to female spawning ratio will be 1:2. Fish that are 60 cm in length or longer are considered adults. Between two and five percent of the broodstock will be composed of jacks, i.e. fish less than 60 cm in length. The percentage reflects the estimated contribution of jacks to the wild spawning population.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Table 7.4.2. Number of hatchery and wild spring Chinook salmon spawned at Warm Springs NFH (CRiS Database 3/18/02).

	Hatchery			Wild		
Year	**Females**	**Males**	**Jacks**	**Females**	**Males**	**Jacks**
1990	448	289	0	0	0	0
1991	272	197	0	0	0	0
1992	294	197	21	28	31	1
1993	161	117	2	0	0	0
1994	28	20	3	0	0	0
1995	48	43	15	0	0	0
1996	364	272	0	16	10	0
1997	296	200	3	0	0	0
1998	355	177	44	0	0	0
1999	393	180	39	0	0	0
2000	279	164	7	29	25	1
2001	246	185	15	19	24	0

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.

Surplus hatchery fish are used to meet the needs of the CTWSRO. Since 2000, approximately 200 adult hatchery spring Chinook salmon have been held at the hatchery and outplanted into Shitike Creek each September. Other surplus fish are killed and distributed to the CTWSRO for tribal needs.

7.6) Fish transportation and holding methods.

Broodstock fish are held and spawned onsite at the hatchery. Fish designated for outplanting are loaded and sorted during spawning at the hatchery and are trucked to Shitike Creek in a 300 gallon tank truck by the CTWSRO.

7.7) Describe fish health maintenance and sanitation procedures applied.

All spring Chinook salmon held for broodstock are injected with erythromycin to prevent pre-spawning mortality by bacterial kidney disease (BKD) and to reduce vertical transmission of its causative agent to their progeny. Formalin is added to the water to control fungus and external parasites during the holding period. At spawning, tissues from adult fish are collected to ascertain viral, bacterial, and parasitic infections and to provide a brood health profile. Personnel from the Lower Columbia River Fish Health Center test for the parasite *Ceratomyxa shasta* and the listed pathogens as defined by USFWS Fish Health Policy and Implementation Guidelines: infectious hematopoietic necrosis virus (IHNV), infectious pancreatic necrosis virus (IPNV), viral hemorrhagic septicemia virus (VHSV), *Renibacterium salmoninarum* (BKD), *Aeromonas salmonicida, and Yersinia ruckeri*. All broodstock are tested and assayed for BKD and virus. If levels of BKD exceed prescribed standards, the progeny from the infected broodstock are either culled or kept segregated during rearing. Sanitation procedures meet or exceed the minimum guidelines set forth in the IHOT report (1995).

7.8) Disposition of carcasses.

Prior to spawning, surplus fish are distributed to the CTWSRO. After spawning, broodstock carcasses are either buried or used for stream nutrient enrichment. Prior to placement in streams, all carcasses are screened by health exams and treated (by evisceration and heat-baking) to prevent potential disease transmission.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

No listed fish are used in the WSNFH spring Chinook salmon broodstock. Risk aversion measures for steelhead passage through the collection facility are discussed in Section 2.2.3.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.

Spawners are randomly collected over the entire run and randomly spawned from ripe fish over a three to four week period.

8.2) Males.

Approximately 40% of the adults collected are males. The intent is to utilize a spawning population of 630 adults and to use a 1:1 male to female spawning ratio. Between 2% and 5% of the broodstock will be jacks, defined as males less than 60 cm in length.

8.3) Fertilization.

Ripe fish are separated out during spawning days at the hatchery. A 1:1 male to female spawning ratio is desired, however the actual ratio may differ based on the number of ripe individuals available.

Fluid is taken from each female, and carcasses of both males and females are checked by the fish health staff for signs of Bacterial Kidney Disease. If signs of gross Bacterial Kidney Disease are detected, the fish health staff informs the hatchery and the spawn products of those fish are removed from production. Eggs from each female are placed in separate numbered buckets and sperm from each male is placed in numbered baggies. Sperm is added to the eggs with approximately 16 ounces of water/sperm extender mix. The female number and male number is written on the bucket used to hold the egg/sperm mixture. The bucket of fertilized eggs is poured into a water/iodophor mixture and allowed to sit for 20 minutes. After the 20 minute waiting period fresh water is turned on the eggs. The eggs are then placed in a darkened room, supplied with a constant flow of water, and given weekly applications of formalin until eye-up. During this time the fertilized eggs from each female are kept separate.

8.4) Cryopreserved gametes.

No cryopreserved gametes are used.

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

No listed fish populations are used in broodstock collection or mating.

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

Table 9.1.1. Survival rates from egg to eye-up, egg to ponding, and ponding to release (CRiS Database 7/11/02).

Brood Year	Eggs Taken	Eye-up (% Survival egg to eye-up)	Ponded (% Survival egg to ponding)	Released* (% Survival ponding to release)
1992	619,102[A]	594,108 (96%)	583,540 (94%)	551,151 (94%)
1993	462,561	421,691 (91%)	381,252 (82%)	398,142 (--)
1994	296,163[B]	320,541[C] (97%)	314,663 (95%)	420,866 (--)
1995	540,869[D]	501,183 (93%)	495,825 (92%)	467,427 (94%)
1996	1,047,542	818,624 (78%)	809,586 (77%)	790,422 (98%)
1997	899,119	834,515 (93%)	834,515 (93%)	815,570 (98%)
1998	1,039,781	992,764 (95%)	830,194 (80%)	770,419 (93%)
1999	1,126,032	959,887 (85%)	838,932 (75%)	827,665 (97%)
2000	857,836	739,910 (86%)	731,465 (85%)	618,822 (85%)
2001	768,071	743,093 (97%)	685,093 (89%)	--

*Number released is an actual count, other numbers are estimated from sample counts.
[A]853,102 eggs were taken, 234,000 were discarded.
[B]Includes 216,449 green eggs transferred from Round Butte Hatchery.
[C]Includes 34,413 eyed eggs transferred from Round Butte Hatchery.
[D]Includes 414,689 eggs transferred from Round Butte Hatchery.

9.1.2) Cause for, and disposition of surplus egg takes.

None

9.1.3) Loading densities applied during incubation.

5,000 eggs per Heath tray

9.1.4) Incubation conditions.

Eggs are kept at 50 degrees F, left undisturbed until eye-up, and then electronically counted, 5,000 per Heath tray.

9**.1.5) Ponding**.

At complete button-up (1,600 temperature units, 1,100 fish per pound) fry are moved into tanks. Ponding usually begins near the end of January and is completed by the end of February.

9.1.6) Fish health maintenance and monitoring.

Formalin is run through the watering system on the eggs until eye-up. After eye-up and during counting, dead eggs are removed by an electronic counter, weighed, sampled, and discarded. After counting, dead eggs are manually picked from the trays and subtracted from the egg count. At ponding, 60 fish are sampled for a health exam.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

No listed fish are reared at Warm Springs NFH.

9.2) Rearing:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available..

See table 9.1.1

9.2.2) Density and loading criteria (goals and actual levels).

Pond densities range from a density index of 0.08 (approximately 0.44 lbs fish/ft^3) to a density index of 0.16 (approximately 0.88 lbs fish/ft^3), based on an average fish size of 20 fish/lb.

Density and loading criteria vary with annual production goals. Current production goals allow for density indices to be kept at or below 0.5, and flow indices to be within accepted standards for spring Chinook salmon (Piper et al. 1982)

9.2.3) Fish rearing conditions

Temperatures in the rearing ponds are monitored daily. Dissolved oxygen levels are monitored on a monthly, weekly, or daily basis as needed. Temperatures during the rearing cycle range from between 32 degrees F to 72 degrees F. Ponds are cleaned by brush twice a week during the summer.

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

Table 9.2.4. Monthly fish growth information for Brood Year 1999 (CRiS Database 7/11/02).

Month	Length (in.)	#/lb	CF[A]	Conversion Rate[B]	D_I[C]	F_I[D]
Jan '00	1.41	1098		0	0.47	1.55
Feb '00	1.90	448		0.3	0.83	2.72
Mar '00	1.99	389		6.89	0.30	0.89
Apr '00	2.38	228		1.95	0.03	0.10
May '00	2.93	122		1.60	0.05	0.15
Jun '00	3.90	52		0.80	0.09	0.27
Jul '00	4.41	36		1.49	0.12	0.35
Aug '00	4.41	36		-	0.12	0.35
Sep '00	4.41	36		-	0.12	0.35
Oct '00	5.02	24		0.65	0.15	0.45
Nov '00	5.02	24		1.11	0.15	0.45
Dec '00	5.36	20		0.19	0.17	0.52
Jan '01	5.36	20		-1.06	0.16	0.49
Feb '01	5.36	20		-	0.16	0.49
Mar '01	5.46	19		3.86	0.17	0.50

[A]CF(Condition Factor)=standard spring Chinook CF of 3.24 taken from Piper et al. 1992
[B]Conversion Rate=lbs of monthly feed/lbs of monthly fish growth, conversion rates may not accurately reflect food conversion due to sampling methodology.
[C]D_I (Density Index)=(weight of fish)/(fish length x volume)
[D]F_I (Flow Index)=(fish weight)/(fish length x water inflow)

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

See Table 9.2.4.

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

Biomoist grower and Biomoist feed is used during rearing. Erythromycin feed (21 days) is used in May and September. Feeding rates range from 1.5% to 3% B.W./day. Conversion rates averaged 1.62 for BY 1999.

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

Fish health is monitored daily by hatchery staff. A fish health specialist visits at least once per month to examine fish in each lot, checking both healthy and symptomatic fish in the rearing ponds. If necessary, the appropriate chemotherapy or cultural changes are administered after consultation with the fish health specialist. Sanitation procedures follow guidelines established by the Fish Hatchery Management manual (Piper et al. 1982).

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

Not currently estimated. Future monitoring work may include smolt development indices.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

Shade coverings have been installed over each rearing pond.

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

No listed fish are incorporated in the Warm Springs NFH spring Chinook salmon program.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1) Proposed fish release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs	-	-	-	-
Unfed Fry	-	-	-	-
Fry	-	-	-	-
Fingerling	75,000	see Sect. 10.3	Mid-October to Mid-November	Warm Springs River
Yearling	750,000	see Sect. 10.3	March-April	Warm Springs River

10.2) Specific location(s) of proposed release(s).

Stream, river, or watercourse: Warm Springs River
Release point: Warm Springs River NFH Rkm 16
Major watershed: Deschutes River Subbasin
Basin or Region: Columbia River Basin

10.3) Actual numbers and sizes of fish released by age class through the program.

Table 10.3. Juvenile release information for Warm Springs NFH by release year. Release dates are the last day of release during the release period (CRiS Database 5/06/02).

Release Year	Spring Release Dates	Number Released	Avg. Fish/lb	Fall Release Dates*	Number Released	Avg. Fish/lb
1990	04/11, 04/16	563,581	17.5	09/26, 11/01	254,513	10.7
1991	04/17, 04/22	816,420	14.8	11/04	8,521	6
1992	04/22	650,986	12	10/01, 11/16	47,257	21
1993	04/22	509,757	17	11/15	23,099	21
1994	04/20	527,565	16	11/16	16,497	13
1995	03/31	381,645	11	11/22	53,001	14
1996	04/10	367,885	11	11/13	30,394	12
1997	04/16	437,033	9	11/14	90,809	16
1998	04/15	699,613	22	11/09	35,718	20
1999	03/04	775,852	19	11/17	91,377	18
2000	04/19	679,042	15	11/15	42,921	22
2001	04/18	784,744	19	11/14	57,975	22

* Fall release is a volitional release of age 0+ spring Chinook salmon (see section 3.5). The number released is based on smolt trapping estimates made during the first year of the fall release program and pond estimates of fish released in the spring. Fall released fish are from the same brood year as fish released in the spring of the following year (e.g. fish released in fall '90 and spring '91 are both from BY '89).

10.4) Actual dates of release and description of release protocols.

See Table 10.3 for actual release dates. Release times were chosen to mimic the life history characteristics of the wild spring Chinook salmon population in the Warm Springs River (Olson et al. 1995). The fall release is a strictly volitional release while spring releases are a combination of volitional and forced releases.

10.5) Fish transportation procedures, if applicable.

All juvenile releases currently occur onsite at Warm Springs NFH. Beginning in 2000, approximately 200 adult fish have been outplanted into Shitike Creek annually. The adult fish are transported using a 300 gallon tank truck with aerated water.

10.6) Acclimation procedures

The water source for Warm Springs NFH is the Warm Springs River. Fish are reared and released onsite.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

All hatchery fish receive an adipose-fin clip and a coded-wire tag before release. The tag retention goal is a minimum 95%.

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

No broodstock or eggs are taken beyond approved levels.

10.9) Fish health certification procedures applied pre-release.

Hatchery operations comply with the USFWS Fish Health Policy and Implementation Guidelines and the Integrated Hatchery Operations Team's Fish Health Policy. Three to six weeks prior to release, 60 fish from each lot are given a health exam. If fish are held longer than one month past the designated release date a second health exam is performed.

10.10) Emergency release procedures in response to flooding or water system failure.

Juvenile fish can be released onsite into the Warm Springs River in response to emergency conditions.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

The goal of the Warm Springs NFH spring Chinook salmon program is to release functional smolts that will quickly migrate to the ocean. Releases are timed to mimic the life history characteristics of the wild population of spring Chinook salmon in the Warm Springs River (Olson et al. 1995). For a discussion of potential adverse impacts from the release program refer to Section 3.5.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

Refer to Section 1.10 for a discussion of how each "Performance Indicator" will be monitored and evaluated.

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

The USFWS expects to continue to fund monitoring and evaluation programs associated with Warm Springs NFH.

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

Potential take associated with monitoring and evaluation activities is discussed in Section 2.2.3. All monitoring and evaluation activities will attempt to minimize adverse effects to listed species.

SECTION 12. RESEARCH

Distribution, Migration Behavior, Habitat Use, and Species Interaction of Fall-Released Juvenile Hatchery Spring Chinook Salmon in the Deschutes River, Oregon.

12.1a) Objective or purpose.

1.) Determine the over-wintering behavior and distribution of fall volitional releases of juvenile hatchery spring Chinook salmon in the Deschutes River.

2.) Determine the migration behavior of juvenile hatchery fish that leave the Deschutes River system and enter the Columbia River.

3.) Investigate hatchery spring Chinook salmon interactions among and between species during over-wintering.

12.2a) Cooperating and funding agencies.

Funding for this study is being provided by the USFWS. The United States Geological Survey (USGS) and the CTWSRO are taking the lead in conducting the study.

12.3a) Principle investigator or project supervisor and staff.

Principle Investigator: Rachel Wardell
Project Leader: Dennis Rondorf

USGS
Columbia River Research Laboratory
5501 A Cook-Underwood Road
Cook, WA 98605
509-538-2299

USFWS: Doug Olson
CRFPO
9317 NE Highway 99, Suite I
Vancouver, WA 98665
360-696-7605

CTWSRO: Bob Spateholts
P.O. Box C
Warm Springs OR
541-553-2045

12.4a) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

Summer steelhead (*Oncorhynchus mykiss*), Mid-Columbia River ESU, threatened

Bull trout (*Salvelinus confluentus*), Columbia River distinct population segment, threatened

The status of summer steelhead in the Warm Springs River and Deschutes River is discussed in Section 2, the status of bull trout is discussed in Section 15.

12.5a) Techniques: include capture methods, drugs, samples collected, tags applied.

A complete discussion of sampling methodology can be found in Attachment A. Juvenile hatchery spring Chinook salmon will be collected at a rotary screw trap located at Rkm 5 of the Warm Springs River. The CTWSRO operate the trap as part of the monitoring and evaluation activities associated with the Warm Springs NFH (see Section 2.2.3). Only juvenile hatchery spring Chinook salmon will be used in the telemetry/PIT tag study. Fish will be collected during the fall trapping period, approximately 15 October to 15 November. Fish will be anesthetized using MS-222 and radio tags will be surgically implanted. Radio-tag size will be no larger than 6% tag weight to fish weight ratio. Up to 100 juvenile hatchery spring Chinook will be radio-tagged. Up to 1000 PIT tags will be applied to juvenile hatchery fish caught in the rotary screw trap. In addition, approximately 60 juvenile hatchery spring Chinook will be sampled for ATPase using non-lethal techniques.

Once fish are tagged they will be tracked throughout the Deschutes River and Columbia River using radio-telemetry and PIT tag monitoring. Three fixed telemetry-stations located on the Deschutes River will monitor movement of radio-tagged fish in the subbasin. Telemetry sites at The Dalles Dam and Bonneville Dam will scan for tagged fish in the mainstem Columbia River. Mobile telemetry receivers and a backpack PIT tag detector will be used for mobile tracking.

12.6a) Dates or time period in which research activity occurs.

Collection will occur between 15 October and 15 November in 2002. Tracking of tagged fish will take place from 15 October through January of the following year. The expected project duration is from 2002 through 2006.

12.7a) Care and maintenance of live fish or eggs, holding duration, transport methods.

Fish will be collected at the rotary screw trap. After fish are anesthetized and tags are implanted, fish will be placed in a recovery container and supplied with a constant flow of river water until they have recovered from the anesthetic. Fish will then be released back into the Warm Springs River, approximately 5 meters downstream of the rotary screw trap.

12.8a) Expected type and effects of take and potential for injury or mortality.

No additional take of listed species beyond that identified in Section 2.2.3 is anticipated as a result of this study. The rotary screw trap is operated as part of the monitoring and evaluation activities associated with Warm Springs NFH (see Section 2). Samples for this study will be taken from fish captured through the normal monitoring activities. Tracking of radio-tagged and PIT tagged fish will take place from the road or in boats and is not expected to result in any take of listed species.

12.9a) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

Take associated with the monitoring and research program in the Warm Springs River is listed in Take Table 1 for listed steelhead and Take Table 3 for listed bull trout.

12.10a) Alternative methods to achieve project objectives.

None at this time.

12.11a) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

Similar species to summer steelhead and bull trout include spring Chinook salmon and resident rainbow trout. No mortality to these species is anticipated from this research project.

12.12a) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

Non-lethal sampling techniques will be applied. The research project intends to use hatchery spring Chinook salmon to investigate potential impacts of hatchery activities on wild fish populations. The rotary screw trap is operated as part of the monitoring and evaluation activities associated with Warm Springs NFH (see Section 2). This research project will use fish collected during the normal monitoring activities. No additional listed fish will be sampled or handled as a result of the research project. Take estimates for steelhead resulting from the monitoring and evaluation program in the Warm Springs River are estimated in Take Table 1 and for bull trout in Take Table 3.

Shitike Creek Outplanting Assessment Study

12.1b) Objective or purpose.

1.) Assess the distribution and behavior of outplanted adult spring Chinook salmon in Shitike Creek.

2.) Estimate the reproductive success of natural-origin and outplanted hatchery-origin spring Chinook salmon in Shitike Creek.

3.) Investigate potential ecological interactions between juvenile spring Chinook salmon, bull trout, and summer steelhead in Shitike Creek.

12.2b) Cooperating and funding agencies.

Funding for this study is being provided by the USFWS and the CTWSRO.

12.3b) Principle investigator or project supervisor and staff.

Principal Investigators:

Doug Olson
USFWS
9317 NE Highway 99, Suite I
Vancouver, WA 98665
360-696-7605

Bob Spateholts
CTWSRO
P.O. Box C
Warm Springs, OR 97761
541-553-2045

12.4b) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

Summer steelhead (*Oncorhynchus mykiss*), Mid-Columbia River ESU, threatened

Bull trout (*Salvelinus confluentus*), Columbia River distinct population segment, threatened

The status of summer steelhead in the Warm Springs River and Deschutes River is discussed in Section 2. The status of bull trout in the proposed work area is discussed in Section 15.

12.5b) Techniques: include capture methods, drugs, samples collected, tags applied.

A full discussion of the sampling design is included in Attachments B and C.

Adult spring Chinook salmon will be trapped using a temporary adult weir located near the mouth of Shitike Creek. The weir is currently being operated by the CTWSRO as part of a bull trout study funded by the Bonneville Power Administration. The adult weir has typically been installed in late April or early May and operated through September. The weir consists of pickets to block migration and both an upstream and downstream live box. Adult fish migrating upstream and downstream are trapped at the weir and sampled by CTWSRO personnel. Sampling takes place in the morning when water temperatures are at their lowest. Sampling includes taking length measurements and scale samples. As part of the spring Chinook salmon program, tissue and scale samples will be collected from all upstream migrating spring Chinook salmon. Water temperatures are monitored on a daily basis, if water temperatures rise above 17 degrees C, pickets in the weir will be removed to allow fish to move upstream and downstream without entering the live boxes. Spring Chinook will be tagged with a numbered floy tag and released upstream of the weir. Hatchery spring Chinook salmon will be sampled at the hatchery before outplanting. Approximately 20 hatchery spring Chinook salmon will be implanted with radio-tags in order to track their movement after outplanting. Redd surveys and telemetry monitoring will occur on a weekly basis from late August through September.

Starting in 2003, the temporary weir will be operated by the CTWSRO spring Chinook monitoring program. The weir has typically been installed in late April or early May, after the main upstream migration of adult summer steelhead. Starting in 2004, the CTWSRO and the USFWS may install the weir as early as January in order to collect information on steelhead populations in Shitike Creek. Information that may be collected on steelhead includes adult population size, the number of stray hatchery steelhead, run-timing, and the genetic make-up of the wild steelhead population. In addition, the USFWS and the CTWSRO may conduct studies on the reproductive success of wild and stray hatchery steelhead in Shitike Creek. Fin-clips, approximately $1cm^2$, would be collected from all upstream migrating adult stray hatchery and wild steelhead trapped at the weir. Fin-clips would then be collected from approximately 1000 juvenile steelhead per brood year collected both at the rotary screw trap and from a random sample of juvenile fish in the stream. Using DNA assignment tests and pedigree analyses, the reproductive success of wild and stray hatchery steelhead would be estimated. Operation of the weir from January to April and implementation of the reproductive success study are currently in the proposal stage, the earliest date for implementation would be January of 2004. The operation and sampling protocol at the weir during the earlier time period (January through March) would follow the current protocols.

Snorkel surveys will also be conducted by the CTWSRO and the Service in order to monitor population abundance of juvenile fish in the Warm Springs River. During a snorkel survey, temporary block-nets will be placed at the upstream and downstream end of a habitat unit. Snorkelers will then visually observe fish in the unit, recording either microhabitat preference or abundance estimates. Snorkelers will make up to three passes through the habitat unit. Once the snorkelers are finished with their survey the block nets will be removed. Snorkel abundance estimates will be supplemented with mark-recapture estimates in a sub-sample of the habitat units (approximately three to six units total). For the mark-recapture estimates, fish will be seined out of the unit and placed into water filled buckets/containers. The fish will then be anesthetized with MS-222, counted, measured, and then placed into a bucket containing a mixture of water and Bismark-brown dye. Fin-clips from juvenile spring Chinook salmon will be collected as part of the reproductive success study. Fin clip may also be collected from juvenile rainbow/steelhead as part of the proposed steelhead reproductive success study. The dye will temporarily (one to three days) dye the fins and body of the fish a light brown color. Once the marked fish have recovered from the anesthetic they will be released back into the habitat unit. The fish will be recaptured either by re-seining or by a snorkel "resight".

In addition, a rotary screw trap located near the mouth of Shitike Creek will monitor juvenile fish outmigration during the spring and fall. The rotary screw trap is operated as part of the CTWSRO's bull trout study. The outplanting evaluation study will use the screw trap to collect tissue samples from approximately 1000 juvenile spring Chinook salmon per year. Tissue samples (fin clips) will be collected during the normal measuring and marking activities associated with the screw trap (see Section 2).

12.6b) Dates or time period in which research activity occurs.

Adult collection will occur at the temporary weir from approximately 1 January to 30 September. Juvenile trapping will occur year round. Snorkel observations are scheduled to begin in late June and early July, 2002. Age 0+ sampling will begin in June or July, 2003. The project is expected to begin in 2002 and continue through 2006.

12.7b) Care and maintenance of live fish or eggs, holding duration, transport methods.

Fish will be collected at the rotary screw trap and by seining in a subsample of habitat units. After fish are anesthetized and samples are taken they are placed in a recovery bucket. Once fish have fully recovered from the anesthetic they are released back into the stream. Fish are held in the rotary screw trap for less than 24 hours and typically held for sampling less than one hour. Fish collected during seining will be held in freshwater until they are fully recovered from the

sampling, approximately five to ten minutes. Fish will then be released back into the stream in the same habitat unit that they were collected from.

12.8b) Expected type and effects of take and potential for injury or mortality.

Potential take as a result of the weir operation may include handling stress and delayed migration of bull trout and summer steelhead. Operation of the weir will be discontinued if stream temperatures rise above an average of 17 degrees Celsius. Take associated with the rotary screw trap may include handling stress, delayed migration, and mortality associated with trap malfunction. Take associated with the seining may result from stress during the seining or handling. Potential take could also result from increased susceptibility to predation for marked fish. The short duration of the mark (one to three days) and the color of the mark (light brown) are expected to minimize the potential take.

12.9b) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

Take associated with the monitoring program in Shitike Creek is included in Take Table 2 for listed steelhead and Take Table 4 for listed bull trout.

12.10b) Alternative methods to achieve project objectives.

None at this time.

12.11b) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

Similar species to summer steelhead and bull trout include spring Chinook salmon and resident rainbow trout. No mortality of these species is expected as a result of this study.

12.12b) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

Juvenile and adult traps will be checked on a daily basis in order to minimize the holding time for listed fish. If high flows are anticipated, the traps will be taken out of operation in order to minimize the likelihood of injury due to trap malfunction or debris overload. Water temperatures will be monitored during all sampling. Pickets in the adult weir will be removed if water temperatures exceed 17 degrees C. The adult weir will only be run Monday-Friday. Pickets will be removed over the weekend to allow fish to migrate upstream and downstream.

Snorkelling will be used whenever possible to limit the amount of handling of listed species.

SECTION 13. ATTACHMENTS AND CITATION

Brun, C. 1999. Bull trout distribution and abundance in the waters on and bordering the Warm Springs Reservation. 1999 Annual Report. Confederated Tribes of the Warm Springs Reservation, Oregon. Prepared for the Bonneville Power Administration Project Number 1994-054.

Brun, C. and R. Dodson, 2001. Bull trout distribution and abundance in the waters on and bordering the Warm Springs Reservation. 2001 Annual Report. Confederated Tribes of the Warm Springs Reservation, Oregon. Prepared for the Bonneville Power Administration Project Number 1994-054.

Cates, B. C. 1992. Warm Springs National Fish Hatchery evaluation and anadromous fish study on the Warm Springs Indian Reservation, 1975-1989. Progress Report. U. S. Fish and Wildlife Service, Lower Columbia River Fisheries Resource Office, Vancouver, Washington.

Cederholm, C. J. 1999. Pacific salmon carcasses: Essential contributions of nutrients and energy for aquatic and terrestrial ecosystems. Fisheries 24 (10): 6-15.

CRiS (Columbia River Information System) Database, Stephen Pastor Database Manager (Stephen_Pastor@fws.gov), United States Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, Washington. http://columbiariver.fws.gov

CTWSRO (Confederated Tribes of the Warm Springs Reservation of Oregon) and USFWS (United States Fish and Wildlife Service), 2002. Warm Springs National Fish Hatchery Operational and Implementation Plan 2002-2006. United States Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, Washington.

Dambacher, J. M. , 2002. Project Report: Relative abundance of juvenile Chinook salmon in Shitike Creek, of the Confederate Tribes of the Warm Springs Reservation, Oregon. Oregon Department of Fish and Wildlife, Corvallis, OR.

Groot, C. and L. Margolis. 1991. Pacific salmon life histories. UBC Press, University of British Columbia, Vancouver, British Columbia.

IHOT (Integrated Hatchery Operations Team), 1996. Operations Plans for (USFWS) anadromous fish production facilities in the Columbia River Basin. Annual Report to the Bonneville Power Administration, Portland, Oregon.

Lindsay, R. B., B. C. Jonasson, R. K. Schroeder, and B. C. Cates, 1989. Spring Chinook salmon in the Deschutes River, Oregon. Oregon Department of Fish and Wildlife, Information Report 89-4, Portland, Oregon.

McNeil, W. J. and D. C. Himsworth. 1980. Salmonid ecosystems of the North Pacific. Oregon State University Press and Oregon State University Sea Grant College Program, Corvallis, Oregon.

NMFS (National Marine Fisheries Service). 1999a. Biological Assessment for Mitchell Act Hatchery Operations. Hatcheries and Inland Fisheries Branch, Portland, Oregon.

NMFS (National Marine Fisheries Service). 1999b. Biological Opinion on Artificial Propagation in the Columbia River Basin, Endangered Species Act - Section 7 Consultation.

Olson, D. E., B. C. Cates, and D. H. Diggs, 1995. Use of a national fish hatchery to complement wild salmon and steelhead production in an Oregon stream. American Fisheries Society Symposium 15:317-328.

Olson, D. E., and B. Spateholts, 2001. Hatcheries harvest and wild fish . . . an integrated program at the Warm Springs National Fish Hatchery, Oregon. In: Proceedings of the 52nd Northwest Fish Culture Conference, December 2001. U. S. Fish and Wildlife Service, Vancouver, Washington. http://columbiariver.fws.gov

Olson, D. E. and S. Pastor, 1998. Warm Springs National Fish Hatchery: An account of summer steelhead returns and strays in the Warm Springs River. U. S. Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, Washington.

Oregon Department of Fish and Wildlife (ODFW), 2001. Deschutes River Subbasin Summary. Mid-Columbia Fish District, Oregon Department of Fish and Wildlife, The Dalles, Oregon.

Oregon Department of Fish and Wildlife (ODFW), 1997. Lower Deschutes River Subbasin Management Plan. Mid-Columbia Fish District, Oregon Department of Fish and Wildlife, The Dalles, Oregon.

Piper, R. G., I. B. McElwain, L. E. Orme, J. P. McCraren, L. G. Fowler, and J. R. Leonard, 1982. Fish hatchery management. United States Department of Interior, Fish and Wildlife Service, Washington D. C.

USFWS (United States Fish and Wildlife Service). 1998. Intra-Service Section 7 biological evaluation form for listed bull trout and Warm Springs National Fish Hatchery operations.

Wardell, R. E., N. S. Adams, D. W. Rondorf, C. Brun, and R. Dodson, 2002. Feasibility study to determine the distribution of juvenile hatchery spring Chinook salmon in the Deschutes River and their potential effect upon the aquatic community, Annual Report for 2000. United States Geological Survey, Biological Resources Division, Columbia River Research Laboratory, Cook, Washington. http://columbiariver.fws.gov

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the foregoing information is complete, true and correct to the best of my knowledge and belief."

Name, Title, and Signature of Applicant:

Certified by_____ Date:_____

Attachment A:
Juvenile Fall Release Evaluation Proposal

Title: Distribution, Migration Behavior, Habitat Use, and Species Interactions of Fall-Released Juvenile Hatchery Spring Chinook Salmon on the Deschutes River, Oregon

Principal Investigators:	Rachel E. Wardell and Patrick J. Connolly
Project Leaders:	Noah S. Adams and Dennis W. Rondorf
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Submitted to:	Doug Olson U.S. Fish and Wildlife Service Columbia River Fisheries Program Office 9317 Highway 99, Suite I Vancouver, WA 98665 doug_olson@fws.gov (360) 696-7605; Fax (360) 696-7968
Administrative Contact:	Michele F. Beeman U.S. Geological Survey, Biological Resources Division Columbia River Research Laboratory 5501A Cook-Underwood Road Cook, WA 98605 (509) 538-2299;Fax (509) 538-2843
Performance Period:	July, 2002 through August 30, 2003

BACKGROUND AND JUSTIFICATION

The U.S. Fish and Wildlife Service's (USFWS) review of National Fish Hatcheries (NFH) practices identified a need to assess the fate of hatchery-reared fish and their potential effect on the aquatic community (USFWS 1998). Additionally, the National Marine Fisheries Service (NMFS) recommended monitoring and evaluation of ecological interactions between hatchery and wild fish (NMFS 1999; Columbia River Biological Opinion). In response to these recommendations and findings, the U.S. Geological Survey (USGS), BRD, conducted a pilot study in 2000, designed to investigate the potential effect of hatchery-reared fish released from the Warm Springs NFH on the aquatic community in the Deschutes River. Results of this study indicated that this type of investigation was feasible and have prompted interest in funding additional research. The second year study is designed to further investigate the fate of hatchery-reared fish and assess habitat use and fish interactions.

Warm Springs NFH is a unique program in the Columbia River basin. The operation of the hatchery is considered pivotal for enhancing salmon stocks to meet tribal trust responsibilities**,** and is also managed to preserve the genetic integrity and characteristics of hatchery and wild fish. Managers are concerned about fall releases of juvenile spring chinook salmon because hatchery fish that over-winter in the Warm Springs and Deschutes Rivers may interact with wild fish. However, quantifying the freshwater fate of juvenile chinook salmon, *Oncorhynchus tshawytscha,* released in the fall from Warm Springs NFH has been problematic (Olson et al. 1995). Typically, about 10% of the hatchery production volitionally exits the hatchery in the fall (30,000 to 75,000 fish). In the past, this fall emigration (early October - early November) included a mixture of sizes, ranging from 70 mm to 229 mm, with the majority of fish being 140 mm or larger (USFWS 1999). Most fish released in the spring reach the Columbia River estuary within 3-4 weeks of release, whereas the destination of fish volitionally released in the fall is not clear. Cates (1992) indicates that fish from the fall release survive and contribute to adult production. Sampling in the lower Deschutes River, at Bonneville Dam, and in the Columbia River estuary indicates that fish released in the fall can exit the Deschutes River during the fall, winter, or spring periods. Recent scale analysis shows that most fall-released fish surviving to adulthood have over-wintered in freshwater before migrating to the ocean in the spring (J.Fryer, Columbia River Inter-Tribal Fish Commission, personal communication). Although the fall volitional release strategy has been successful in contributing to adult returns (Olson 1998), managers are concerned that large numbers of hatchery fish rearing in the Deschutes River may negatively affect the freshwater aquatic community. These over-wintering hatchery salmon could displace or compete with wild fish in the Deschutes River.

In 2000, we conducted a pilot study to determine the distribution of fall-released fish in the Deschutes River and investigate methods to assess habitat use. Fifty-four fish were implanted with radio transmitters and tracked for 45-75 days. Over the study period, we found that 65% of the radio-tagged fish remained in the Deschutes River, indicating that there were a substantial number of fish remaining over the winter. With the majority of fish remaining in the Deschutes, there could be a potential impact on wild juvenile spring chinook salmon, bull trout, steelhead, rainbow trout, and other resident fish. Habitat assessments conducted during the pilot study at sites where radio-tagged fish were found indicated that these fish select discrete microhabitat. If there is interspecies overlap in

microhabitat use and potential antagonistic behavior caused by hatchery-released fish, managers may need to review current practices. However, if there is not much interaction or overlap in microhabitat use, the hatchery-released fish may be able to coexist in the Deschutes River. The proposed study is intended to expand the work conducted in 2000 and further develop the habitat and ecological interactions assessment. The study will focus on determining the distribution of fall-released hatchery spring chinook salmon, assessing microhabitat, addressing potential interactions within the fish community in the Deschutes River, and assess possible ways of quantifying habitat.

OBJECTIVES AND METHODOLOGY

Objective 1: Determine the over-wintering behavior and distribution of fall volitional releases of juvenile hatchery spring chinook salmon in the Deschutes River.

Task 1.1: Use radio telemetry techniques to track fish throughout the Lower Deschutes River. We propose to tag 100 fish (Two size groups, 50 fish each).

Subtask 1.1.1: Select a suitable radio tag.

Activity: Consult with Lotek Engineering and Advanced Telemetry Systems (ATS). Research tag attributes (burst interval, battery life, dimensions, weight) as well as special options (activation programming, delayed wake up, and slower burst rate) to find a tag suitable for desired fish size and length of study.

Schedule:

May through July, 2002

Subtask 1.1.2. Surgically implant radio tags in 100 juvenile hatchery spring chinook salmon.

Activity: Trap juvenile hatchery chinook salmon, in conjunction with personnel from the Confederated Tribes of Warm Spring, in the Warm Springs River and select from two distinct groups: 50 fish between 120 mm and 149 mm, and 50 fish 150 mm and larger. Surgically tag fall-released fish as described by Adams (1998). Record biological measurements including length, weight, and overall condition.

Schedule:

October 15 through November 15, 2002

Subtask 1.1.3. Determine travel times of radio-tagged fish from tagging location to fixed locations along the Deschutes River.

Activity: Set up and test four fixed-site receiving stations at predetermined locations on the banks of the Deschutes River. Aerial antennas and receivers will be positioned at locations downriver of the tagging site on the Deschutes River. Proposed monitoring locations: Mouth of Deschutes River(rkm 2), Oak Springs Hatchery (rkm 84), near the mouth

of the Warm Springs River (rkm 130), and upstream of the confluence of the Warm Springs River (rkm 140). Receivers will be downloaded onto laptop computers 1-2 times per week.

Schedule:

October1 through October 15, 2002

Subtask 1.1.4. Monitor fish movements, using vehicles and boats, in the Deschutes River.

Activity: Set up mobile-tracking equipment on vehicle and boat to allow us to monitor small-scale movements of fish. Equipment will include YAGI antenna and receiver. Once a fish is located, we will record a GPS position and mark the location on a map.

Schedule:

November 1, 2002 through January 2003

Task 1.2: Conduct physiological sampling (ATPase) before fall volitional release (hatchery) and at the migrant trap to determine developmental condition before and during time of migration out of the Warm Springs River.

Subtask 1.2.1. Determine developmental condition of fish in the hatchery at time of volitional releases.

Activity: Collect and sample a total of 360 fish (60 each from six raceways) at the hatchery. Sampling will take place concurrently with the U.S. Fish and Wildlife Health Center. No additional fish will be sampled.

Schedule:

October through November 2002

Subtask 1.2.2. Determine developmental condition of fish during migration in the Warm Springs River.

Activity: Collect juvenile hatchery chinook salmon at the downstream migrant trap in the Warm Springs River concurrently with radio tagging. We will use non-lethal techniques, as described in Schrock et al (1994), to sample 60 fish representing each of the two radio-tagged size groups. Fish that are non-lethally sampled are not used in the telemetry portion of the study.

Schedule:

October through November 2002

Task 1.3: Determine habitat characteristics of areas where radio-tagged fish are holding.

Activity: Conduct habitat assessment in areas where radio-tagged fish are found holding. Macrohabitat descriptors at fish locations include habitat unit descriptions, substrate type, percent cover, and bank association of fish and habitat type, as described by Baine and Stevenson (1999).

Schedule:

November 2002 through January 2003

Objective 2: Determine the migration behavior of fish that leave the Deschutes River system and enter the Columbia River.

Task 2.1: Monitor fish movements on the Columbia River below The Dalles and Bonneville Dams, using radio telemetry fixed-site stations.

Activity: Use existing U.S. Geological Survey telemetry receiving arrays at various locations along the Columbia River. Aerial antennas and receivers will be positioned at locations downstream of the Deschutes River. Proposed locations: Below The Dalles Dam (rkm 318), and Bonneville Dam (rkm 242). Receivers will be downloaded onto laptop computers and maintained 1-2 times per week.

Schedule:

November 1 2002 through January 2003

Objective 3: Determine feasibility of using PIT-tag technology to determine distribution of juvenile hatchery spring chinook salmon in the Deschutes River.

Task 3.1: PIT-tag fish at the downstream migrant trap to incorporate a wider size range of fish representative of those that are volitionally released from the hatchery.

Task 1.1. Develop remote and backpack PIT-tag readers to track time and size at release, travel time, residence time, and habitat use.

Activity: Portable Passive Integrated Transponder (PIT tag) detection systems have been developed to monitor individual fish movements within a stream (similar to those in: Zydlewski et al. 2001; Roussel et al. 2000). This allows exact location information for fish that do not move during high water events or at the end of a predicted migration. This system is currently being used to monitor habitat use, winter survival, and level of residualization of coho salmon, cutthroat trout, and steelhead trout in Abernathy Creek (a tributary of the Columbia River). Similar application of this backpack unit may be applied in the Deschutes River to assess distribution and migration behavior of fish that are smaller than the minimum size of radio-tagged fish. The backpack unit has been shown to be able to locate an individual fish to within a 15 cm^2 area. Individual areas and microhabitats are mapped and characterized for each fish. Habitat characterization is completely dependent on the behavior of the detected fish.

Schedule:

November 1 2002 through January 2003

Objective 4: Investigate techniques to determine hatchery chinook interactions among and between species during over-wintering .

Task 4.1: Determine the feasibility of quantifying available habitat in the Deschutes River for future analysis of ecological interaction among and between species, ultimately assessing carrying capacity

Subtask 4.1.1. Document habitat overlap of radio-tagged fish with other fish species.

Activity: Compare Macrohabitat and site-specific surveys used by radio-tagged fish with habitat use identified by other agencies. Review past habitat assessments conducted by Oregon Department of Fish and Wildlife, Bureau of Land Management, The Confederated Tribes of the Warm Springs Reservation, Oregon, PGE, and other agencies working in the Deschutes River Basin, to determine if radio-tagged fish are using similar habitats to other species.

Schedule:

November 2002 through January 2003

Subtask 4.1.2. Use GIS technology to quantify available habitat in the Lower Deschutes River.

Activity: Investigate available GIS resources (i.e. aerial photographs, topographic maps, etc.) to determine feasibility of quantifying habitat availability using GIS software (ArcView or similar technology).

Schedule:

January through February, 2003

Task 4.2: Conduct literature review of behavioral interaction studies of juvenile salmonids.

Activity: The relevant literature from the behavioral and fisheries sciences will be reviewed to summarize research on behavioral interactions between various species of salmonids, with an emphasis on the influence of hatchery spring chinook salmon on other fish. The focus of this review will be to describe: (1) the types of interaction studies that have been done; and (2) the various experimental systems that have been used to conduct such studies. Included will be a discussion of the advantages, disadvantages, and design considerations of the various experimental systems (e.g., aquaria, mesocosms, in-stream enclosures) used to conduct such studies. The goal of this review is to help plan and guide future species interactions studies that may occur within the scope of the Warm Springs-Deschutes River research plan.

Schedule:

A draft version of the review will be completed by December 31, 2002.

FACILITIES AND EQUIPMENT

The USGS Columbia River Research Laboratory is equipped with many of the resources necessary to successfully complete this study. Personnel with extensive experience in state of the art radio-telemetry research are available for assistance. Laboratory and office space and equipment, including desktop computers and software are available. In addition, we have a state of the art GIS computer system and software at the lab. A variety of field equipment, including telemetry receivers, research boats and rafts, and a fleet of vehicles are available. **Boats will be operated at no cost with no additional lease cost to the project**. Only Department of Interior (DOI) certified boat operators trained in CPR and First Aid will operate DOI boats. Furthermore, USGS will provide a quality control system consistent with the Good Laboratory Practices Act.

SPECIAL PROVISIONS

ESA consultation, and state permits will be applied for and obtained prior to conducting field work. An on-site job hazard analysis will be conducted to ensure project safety.

COOPERATORS/PARTNERS

Through our cooperative efforts we can efficiently carry out this research. Warm Springs National Fish Hatchery works closely with the U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office on hatchery evaluation. Together they have formed working relationships with the Oregon Department of Fish & Wildlife (ODFW) and the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO). The U.S. Fish and Wildlife Service, CTWSRO, and U.S. Geological Survey will be cooperators and some of their participation will be covered under other existing or new programs. Working together, we can contribute through cooperation on tasks including trapping, tagging, physiological assessment**,** tracking, instream sampling, data analysis, and reporting. Using existing equipment and resources, costs will be minimized. For example, **the Columbia River Research Laboratory of the Biological Resources Division would be loaning $140,000 worth of equipment to conduct this study.** The U.S. Fish & Wildlife Service and CTWSRO will be allocating resources for planning, sampling, analysis & reporting, along with capital equipment such as a downstream migrant trap, boats, and rafts.

LIST OF KEY PERSONNEL AND PROJECT DUTIES

Personnel	Organization	Project Duties
Dennis Rondorf	BRD	Project Leader
Doug Olson	USFWS	FWS Project coordinator
Noah Adams	BRD	Project Leader
Rachel Wardell	BRD	Principal Investigator (Radio telemetry Lead, project coordination)
Robin Schrock	BRD	Physiology Lead
Patrick Connolly	BRD	Principal Investigator (Habitat/PIT-tag Lead)
Matthew G. Mesa	BRD	Species Interactions Lead
Bob Spateholts	CTWSRO	Cooperator (project coordination and support)
Gayle Zydlewski	USFWS	Cooperator (PIT-tag)

SAMPLING SCHEDULE

	October	November	December	January
Tagging of juveniles	5-10 days			
ATPase sampling	5-10 days			
Vehicle and boat surveys		Every week	Every week	Every week
Fixed-site downloading		Every week	Every week	Every week
Habitat assessments		2 days/week	2 days/week	2 days/week

REPORTING DEADLINES

Draft Report: 23 May, 2003
Review Comments 30 June, 2003
Final Report 11 August, 2003

REFERENCES

Adams, N. S., D. W. Rondorf, S. D. Evans, and J. E. Kelly. 1998. Effects of surgically and gastrically implanted radio transmitters on growth and feeding behavior of juvenile chinook salmon. Transactions of the American Fisheries Society 127:128-136.

Cates, B. C. 1992. Warm Springs National Fish Hatchery evaluation and anadromous fish study the Warm Springs Indian Reservation of Oregon, 1975-1989. Progress Report. U.S. Fish and Wildlife Service, Lower Columbia River Fishery Resource Office, Vancouver, Washington.

NMFS. 1999. Biological Opinion on artificial propagation in the Columbia River Basin. National Marine Fisheries Service. Hatcheries and Inland Fisheries Branch, Portland, Oregon.

Olson, D. E. 1998. Investigation of rearing & release strategies affecting adult production of spring chinook salmon. In:Proceedings of the Forty-Eighth Northwest Fish Culture Conference, December 1997. U.S. Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, Washington.

Olson, D.E., B. C. Cates, and D. H. Diggs. 1995. Use of a National Fish Hatchery to complement wild salmon and steelhead in an Oregon stream. American Fisheries Society Symposium 15:317-328.

Roussel J-M., A. Haro, and R. A. Cunjak. 2000. Field test of a new method for tracking small fishes in shallow rivers using passive integrated transponder (PIT) technology. Canadian Journal of Fisheries and Aquatic Sciences 57, 1326-1329.

Schrock, R. M., J. W. Beeman, D. W. Rondorf, and P. V. Haner. 1994. A microassay for gill sodium, potassium-activated ATPase in juvenile Pacific salmonids. Transactions of the American Fisheries Society 123:223-229.

USFWS. 1998. Evaluation of Alignment, Appropriateness, and Adequacy of Propagation Programs at National Fish Hatcheries. U.S. Fish and Wildlife Service. Internal Report from Region 1 Office. Portland, Oregon.

USFWS. 1999. Hatchery and genetic management plan for spring chinook salmon at Warm Springs National Fish Hatchery. U.S. Fish and Wildlife Service. Portland, Oregon.

Zydlewski, G. Barbin, A. Haro, K. G. Whalen, and S. D. McCormick. 2001. Performance of stationary and portable passive transponder detection systems for monitoring of fish movements. Journal of Fish Biology 58, 1471-1475.

Attachment B

Distribution, Behavior, and Reproductive Success of Outplanted Hatchery Spring Chinook Salmon in Shitike Creek, OR

Work Plan for 2003

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Introduction

In the late summer of 2000 the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO) and the United States Fish and Wildlife Service (Service) initiated an adult spring Chinook salmon (*Oncorhynchus tshawytscha*) outplanting program in Shitike Creek, a tributary of the Deschutes River located entirely within the Warm Springs Indian Reservation. Shitike Creek flows approximately 61km from its headwaters near Mt. Jefferson before entering the Deschutes River at Rkm 155. Shitike Creek and the Warm Springs River are the only tributaries of the Deschutes River that currently support natural spawning populations of spring Chinook salmon. Warm Springs National Fish Hatchery, located on the Warm Springs River, produces a hatchery run of spring Chinook that supports both Tribal and sportfishing harvest opportunities in the Deschutes River and in the main-stem of the Columbia River. The hatchery is cooperatively managed by the Service and the CTWSRO to protect wild spring Chinook and steelhead (*Oncorhynchus mykiss*) populations in the Warm Springs River subbasin. As part of this management plan, the majority of returning adult hatchery fish are harvested or taken into the hatchery. Returns of wild spring Chinook salmon to a fish ladder located at Warm Springs National Fish Hatchery (Rkm 16) from 1978 to 2002 have averaged 1313 fish (SD=659, range of 237 to 2705). The density, or redds per mile, of spawning spring Chinook in Shitike Creek is much lower than in the Warm Springs River and it is thought that the habitat in Shitike Creek is under-seeded (Lindsay *et al*. 1989). A water intake dam was built on Shitike Creek (Rkm 11.5) in the mid-1960's that blocked upstream movement of adult salmon and restricted spring Chinook spawning to the lower section of the creek. The water intake dam was removed in 1983. Habitat improvements and fish passage projects have been ongoing in Shitike Creek since removal of the intake dam. Despite these efforts, natural production of spring Chinook salmon in the drainage remained at relatively low levels. Indexed redd counts in Shitike Creek, conducted annually since 1986, ranged from a low of six in 1996 to a high of 33 in 1997 (CTWSRO unpublished data).

Shitike Creek also supports a population of summer steelhead that is part of the Mid-Columbia ESU listed as a threatened species, resident rainbow trout (*Oncorhynchus mykiss*), and bull trout (*Salvelinus confluentus*) that are part of the Columbia River distinct population segment that is listed as a threatened species. The CTWSRO have monitored summer steelhead populations in Shitike Creek since the early 1990's and bull trout populations since 1998 (Brun and Dodson 2001; CTWSRO unpublished data). Summer steelhead appear to spawn and rear throughout the lower 40 Rkm of the creek while bull trout spawn and rear primarily in the upper sections of the creek, above approximately Rkm 30 (Brun and Dodson 2001). Based on spring Chinook indexed redd counts and snorkel surveys conducted by the tribes, spring Chinook primarily spawn and rear in habitats below Rkm 40, in approximately the same distribution as summer steelhead

During the summer of 2000 the Service and the CTWSRO initiated an adult outplanting program. This outplanting program is designed to boost the spawning population of spring Chinook salmon in Shitike Creek by releasing adult hatchery spring Chinook salmon from Warm Springs National Fish Hatchery into the Shitike Creek just prior to spawning. The hatchery has a

broodstock collection goal of 630 spring Chinook salmon for normal hatchery operations. The hatchery began collecting an additional 200 hatchery spring Chinook salmon for the outplanting program. Returning hatchery fish are collected for broodstock and outplanting proportionately throughout the run based on wild Warm Springs River stock run-timing (Warm Springs NFH Operational Plan 2002-2006). During spawning days at the hatchery, usually in late August and early September, the CTWSRO loads fish for outplanting into an aerated tank truck and hauls them to one of five sites on Shitike Creek. The hatchery fish are released into the stream and are allowed to spawn naturally.

In 2000, a total of 159 hatchery spring Chinook salmon were released at five outplant sites in Shitike Creek. The five sites were selected by the CTWSRO based on access considerations and an estimation of available spawning habitat in different reaches of the creek. The five outplant sites, shown in Figure 3, are as follows: Thompson's Bridge (Rkm 6.5), Headworks (Rkm 9.2), Bennetts (Rkm 12.7), Upper Crossing (Rkm 16.6), and Peter's Pasture (Rkm 40). The goal of the program is to annually release 200 hatchery spring Chinook salmon into Shitike Creek, although the actual number outplanted has varied according to returns to the hatchery and broodstock needs. Since hatchery broodstock fish and fish for outplanting are collected throughout the run, the sex-ratio of the outplanted fish reflects the sex-ratio of returning Warm Springs hatchery fish.

Table 1. Number of hatchery spring Chinook salmon outplanted into Shitike Creek. Lower numbers in 2002 were due to high pre-spawning mortality (see Results section).

Year	Male	Female	Total
2000	49	110	159
2001	75	123	198
2002	63	20	83

The contribution of the outplanted hatchery fish to the spawning population is not known but it is assumed that some of the outplanted fish successfully spawned. Outplanted hatchery fish are selected from hatchery fish at Warm Springs National Fish Hatchery, whose life history traits closely mimic those of the wild population in the Warm Springs River (Olson and Spateholts 2001). The spawning success of hatchery spring Chinook salmon from the Warm Springs hatchery in the natural environment is not known. Several studies have shown a difference in performance and behavior between wild and hatchery adult fish (Reisenbichler and Rubin 1999). Burgert *et al*. (1991) reported that wild spring Chinook adults behaved differently from hatchery adults in the Tucannon River and selected spawning sites further upstream than hatchery fish. Since salmon mating is non-random, any differences in aggressiveness, size, spawning time, or other life history trait between hatchery and wild fish could potentially limit the amount of interbreeding (Quinn 1997). Information on the morphological, behavioral, and life-history characteristics of both the outplanted hatchery fish and natural-origin fish is needed in order to effectively monitor the success and/or impacts of the program.

The Service and the CTWSRO received funding in 2002 to evaluate the outplanting program in Shitike Creek and investigate potential ecological interactions between wild and hatchery fish. As part of this evaluation, the Service and the CTWSRO have implemented a program to assess the distribution, behavior, and reproductive success of outplanted hatchery spring Chinook salmon in Shitike Creek. The two objectives of the evaluation are to 1) assess the distribution and behavior of outplanted spring Chinook salmon in Shitike Creek using radio-telemetry, and 2) estimate the reproductive success of natural-origin and outplanted hatchery-origin spring Chinook salmon in Shitike Creek using pedigree analyses.

Work Plan 2003

Adult Radio-Telemetry

Outplanting of hatchery fish into Shitike Creek is expected to continue in 2003. Assuming that disease problems and pre-spawning mortality are not as severe as in 2002, the goal is to outplant 200 adult hatchery spring Chinook salmon into Shitike Creek. A total of 14 radio-transmitters were either recovered off of outplanted fish or not used in 2002. It is expected that funds will be available to buy 21 new radio-transmitters making a total of 35 available for attachment in 2003. Attachment of the radio-transmitters is expected to be similar to the previous year. Assuming that six loads of fish will be outplanted, five to six fish will be radio-tagged per load. The male to female tagging ratio will again be skewed towards females in order to provide more opportunity to locate redds and observe spawning behavior.

Telemetry tracking equipment and personnel will be increased in order to spend more time on the stream observing fish. A fixed-site telemetry station will be set up near the mouth of Shitike Creek (Rkm 0.5). Another fixed-site station will be set up in the upper basin, most likely near Upper Crossing (Rkm 16.5). Two mobile telemetry receivers will be available for tracking. Fish will be tracked on a daily basis. In 2003, at least one group of outplants will be tracked immediately after release in order to determine behavior/recovery time from transportation.

Objective: Assess the distribution and behavior of outplanted spring Chinook salmon in Shitike Creek.

Task 1.1. Tag hatchery spring Chinook salmon prior to outplanting with colored floy tags and/or radio-transmitters.

Activity: Externally radio-tag a subsample of outplanted hatchery spring Chinook salmon. Transmitters will be attached at the base of the dorsal fin using wire-gauge needles and colored disk tags as backing. A total of 35 radio-transmitters will be externally attached. Six to eight loads of fish (25-30 fish/load) will be outplanted into Shitike Creek. Four to six fish will be radio-tagged per load. A stratified random selection of fish will be tagged with fish stratified by sex. Tagging will be weighted towards females in order to increase the probability of finding radio-tagged fish on redds.

Schedule: Mid-August to Mid-September. Tagging will take place on all outplant days.
Personnel: 2 USFWS, 1 CTWSRO

Task 1.2. Determine the distribution of radio-tagged spring Chinook salmon in Shitike Creek.

Activity: Track radio-tagged fish using mobile-tracking equipment and fixed-site telemetry stations. Radio-tagged fish will be tracked upon release into Shitike Creek using a portable Lotek receiver and YAGI antenna. Once a fish is located, the location will be recorded using a GPS system and marked on a map. Fixed-site stations will be located near the mouth of Shitike Creek (Rkm 0.5) and near Upper Crossing (Rkm 16.5). Radio-tagged fish will be tracked until initiation of spawning activity. When fish move onto redds, the redds will be flagged and recorded on a map.

Schedule: Late August through September, 3-4 days/week. Radio tracking will take place on a weekly basis as fish are outplanted and continue through spawning.
Personnel: 1 USFWS, 1 CTWSRO

Task 1.3. Determine the mate choice and redd characteristics of outplanted spring Chinook salmon.

Activity: When spawning fish are found either through radio-telemetry or spawning surveys, the origin of the mate will be recorded as either outplanted or wild. If carcasses of fish are found, the carcasses will be examined in order to estimate spawning success based on gamete retention. Once redds have been abandoned the redd characteristics (length, width, gravel size, water velocity) will be measured and recorded. The habitat in the areas surrounding the redds will also be characterized to determine if outplanted and natural origin fish spawn in similar habitats.

Schedule: Late August through September, 2 days per week.
Personnel: 1 USFWS, 1 CTWSRO

Reproductive Success

The original objective of the reproductive success monitoring program was to sample 100% of the outplanted spring Chinook salmon and 100% of the natural-origin spring Chinook salmon in Shitike Creek. While 100% of the outplanted population was sampled in 2002, high-flows and five-day per week operation of the weir resulted in no tissue samples for the natural-origin population. Due to concerns about the weir operation on listed bull trout populations and

the logistical problems of operating the weir seven days per week the Service and the CTWSRO have modified the sampling design for 2003. The weir will be moved to a location just downstream of the 2002 location. This new location is expected to reduce the risk of damage to the weir from high flows. In addition, after consultation with the USFWS Conservation Genetics Lab in Abernathy, WA, it was decided that a sampling rate of less than 100% would still allow for a comparison of reproductive success. While sampling less than 100% of the population will not allow for a determination of exact parentage of juveniles, a comparison of the relative reproductive success can be made if the proportion of the adult population that was sampled is known (William Ardren UWSFS personal communication). For 2003, a sampling goal of at least 50% of the natural-origin population has been set. The weir will only be operated from early Monday morning to late Friday evening. During the weekends, pickets in the weir will be removed to allow fish to migrate up Shitike Creek unimpeded. A mark-"re-sight" method will be used to estimate the proportion of the natural-origin population that was sampled at the weir. Fish sampled at the weir will be marked with a floy-tag and opercle punched on the left side of the fish. Outplanted fish will be floy-tagged on the right side. Re-sight surveys will be conducted by snorkeling the stream and counting the number of marked and unmarked spring Chinook. The proportion of marked to unmarked fish or carcasses will be used to estimate the total population.

Genetic sampling will begin on progeny from the 2002 outplant brood. A minimum of 1000 fin clips from progeny of the 2002 will be collected from the rotary screw trap near the mouth of Shitike Creek and during in-stream sampling. Based on screw trap data from 2001 and 2002 it appears that newly emergent age 0+ spring Chinook are caught as early as mid-May. Genetic sampling for age 0+ fish will begin in the spring of 2003. Sampling will continue for age 0+ during the fall trapping period (October-December) and fin-clips will also be taken from age 1+ smolts in the spring of 2004. Sampling at the screw trap will be done proportionately throughout the migration. In-stream sampling will take place during mark-resight snorkel surveys conducted as part of the Shitike Creek juvenile fish interactions assessment. In-stream sampling will occur in randomly selected reaches of the stream.

Objective: Estimate the reproductive success of natural-origin and outplanted hatchery-origin spring Chinook salmon in Shitike Creek using genetic pedigree analyses.

Task 1.1. Collect fin-clips for genetic analysis from at least 50% of the natural-origin and 100% of the outplanted hatchery-origin spring Chinook salmon in Shitike Creek.

Activity: Install and operate an adult weir near the mouth of Shitike Creek. The adult weir will be installed and operated as soon as stream conditions permit, at least May through August. The goal is to sample at least 50% of the naturally migrating adult spring Chinook. Length measurements, scale samples, and fin clips will be collected from all adult spring Chinook passing through the weir. Fin-clips, approximately a 1 cm^2 area, will be taken from the caudal or pectoral fin and preserved in 100% ethanol. Fish will then be tagged with a numbered floy tag and an opercle punch. Fish will then be passed upstream. Fin-clips will also be collected from carcasses encountered during redd surveys if it can be

determined that the fish were not previously sampled at the weir (based on opercle punch/floy-tag). A mark-resight snorkel survey will be done in mid-August to estimate the total number of naturally migrating spring Chinook in the creek. Outplanted hatchery-origin spring Chinook will be sampled at the hatchery as the fish are sorted for outplanting. Data collection for outplanted fish will be the same as for natural-origin fish. Data collection is expected to continue for three complete brood cycles.

Schedule: The adult weir will be operated five days per week from May through September through 2006 (potentially longer based on update of Operational Plan in 2006, three complete brood cycles would be through 2008).
Personnel: 2 CTWSRO

Task 1.2. Collect fin-clips from a minimum 1,000 juvenile spring Chinook outmigrants per brood year.

Activity: Juvenile spring Chinook outmigrants will be sampled at a rotary screw trap located near the mouth of Shitike Creek and in-stream during mark-resight snorkel surveys associated with the Shitike Creek juvenile fish interactions assessment. Fin-clips will be collected from subyearling and yearlings proportionately throughout the outmigration period. Scale samples and lengths will be used to determine brood year. Sampling for subyearlings from the 2002 brood will begin in May. Sampling of subyearlings will continue through the fall trapping period. In 2004, age 1+ and age 0+ will be sampled. At the screw trap, fin-clips will be collected on days when fish are marked for trap efficiency estimates. Fin-clips will be stored in Nalgene bottles filled with 100% ethanol. Samples will be stratified by day with all fin-clips from a particular day placed in the same bottle. For in-stream sampling, lengths and weights will be collected from each fish and the fin-clips will be stored in individual containers.

Schedule: May-June, October-November (screw trap)
June-August (in-stream sampling)
Personnel: 2 CTWSRO, 2USFWS

Task 1.3. Determine genotypes of all adult spring Chinook upstream of the weir and a subsample of juveniles outmigrating from Shitike Creek.

Activity: Determine multi-locus genotypes at 10-15 micro-satellite nuclear DNA loci for each adult spring Chinook salmon upstream of the weir. Obtain similar data for a minimum of 1,000 progeny of each brood year and determine the parent of each juvenile fish via DNA assignment tests and pedigree analyses. Continue for three complete brood cycles to evaluate the return rate of the progeny of natural-origin and outplanted hatchery-origin adults.

Schedule: Completed by 2006
Personnel: USFWS Conservation Genetics Lab, Abernathy WA

Objective 1
Adult Distribution/Behavior (2003)

	Aug. 17-23	Aug. 24-30	Aug. 31-Sept. 6	Sept. 7-13	Sept.14-20	Sept. 21-27
Tagging-Personnel-	1 day 3 people	1 day 3 people	1 day 3 people			
Telemetry-Personnel-	2 days 2 people	2 days 2 people	2 days 2 people	2 days 2 people	2 days 2 people	
Surveys-Personnel-	1 day 3-4 people	1 day 3-4 people	1 day 3-4 people	1 day 3-4 people	1 day 3-4 people	
Redd meas.-Personnel-					2 days 2 people	2 days 2 people

Objective 2
Reproductive Success

	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Adult weir							
Hatchery outplants							
Juvenile Outmigrants							
Subyearlings in Shitike Cr.							

References

Brun, C. and R. Dodson, 2001. Bull trout distribution and abundance in the waters on and bordering the Warm Springs Reservation. 2001 Annual Report. Confederated Tribes of the Warm Springs Reservation, Oregon. Prepared for the Bonneville Power Administration Project Number 1994-054.

Burgert, R., C. Busack, G. Mendel, L. Ross, K. Petersen, D. Marbach and J. Dedloff. 1991. Lower Snake River compensation plan Tucannon River spring Chinook salmon hatchery evaluation program, 1990 Annual Report. Washington Department of Fisheries. 81 pp.

Dambacher, J. M. Project Report: Relative abundance of juvenile Chinook salmon in Shitike Creek of the Confederated Tribes of the Warm Springs Reservation, Oregon. 2002. Oregon Department of Fish and Wildlife, Corvallis OR.

Lindsay, R. B., B. C. Jonasson, R. K. Schroeder, and B. C. Cates, 1989. Spring Chinook salmon in the Deschutes River, Oregon. Oregon Department of Fish and Wildlife, Information Report 89-4, Portland.

Nigro, A. A. and D. L. Ward, 1985. Annual Progress Report: Evaluation of lower Umatilla River channel modifications below Three Mile Dam, 1984. Bonneville Power Administration, Portland, OR.

Olson, D. E. and B. Spateholts, 2001. Hatcheries harvest and wild fish . . . an integrated program at the Warm Springs National Fish Hatchery, Oregon. U.S. Fish and Wildlife Service, Vancouver, Washington. Presented at the 52nd Annual Pacific Northwest Fish Culture Conference Hosted by the Oregon Department of Fish and Wildlife, Portland, OR.

Pearsons, T. N., G. A. McMichael, S. W. Martin, E. L. Bartrand, J. A. Long, and S. A. Leader.1996. Yakima species interactions studies annual report 1994. Project Number 89-105 Bonneville Power Administration, Portland, OR.

Quinn, T. P. 1997. Homing, straying, and colonization *in* W. Stewart Grant, editor. Genetic effects of straying of non-native hatchery fish into natural populations: proceedings of the workshop. U.S. Dep. Commerce, NOAA Tech Memo. NMFS-NWFSC-30, 130p.

Reisenbichler, R. R. and S. P. Rubin. 1999. Genetic changes from artificial propagation of Pacific salmon affect the productivity and viability of supplemented populations. ICES Journal of Marine Science 56: 459-466.

Underwood, K. D., S. W. Martin, M. L. Schuck, and A. T. Scholz. 1995. Investigations of bull trout (*Salvelinus confluentus*), steelhead trout (*Oncorhynchus mykiss*), and spring Chinook salmon (*O. tshawytscha*) interactions in southeast Washington streams. Project Number 90-053 Bonneville Power Administration, Portland, OR.

Warm Springs National Fish Hatchery Operational Plan and Implementation Plan 2002-2006. United States Fish and Wildlife Service and the Confederated Tribes of the Warm Springs Reservation of Oregon.

Zar, J. H. 1984. Biostatistical Analysis, 2nd edition. Prentice Hall, Englewood Cliffs, New Jersey.

Attachment C

Microhabitat Selection of Juvenile Steelhead Trout, Juvenile Chinook Salmon, and Bull Trout Within Shitike Creek, OR at Varying Fish Densities.

Introduction

The Service and the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO) received funding in 2002 to and investigate potential ecological interactions between hatchery and wild fish (FONS Project Number 1999-010). As part of this evaluation, the Service and the CTWSRO are planning to implement a survey to evaluate microhabitat use of juvenile spring Chinook salmon, juvenile steelhead trout, and bull trout. The results of the evaluation would be used by National Fish Hatchery personnel, and managers of natural resources, to mitigate and reduce ecological interactions between hatchery and wild fish. The following project objectives are proposed for fiscal year 2003.

Objectives:

1) Identify microhabitat selection (depth, water velocity, species association, cover use, temperature) juvenile Chinook salmon, juvenile steelhead trout and Bull trout within Shitike Creek at varying densities (fish/m^3).

2) Determine if there is a relationship between microhabitat selection and fish density in slow and fast-water channel units.

Potential Management Action: Adjust or manipulate the number or location of adult Chinook outplantings to maximize number of chinook produced but minimize any density effects on microhabitat selection of juvenile steelhead trout or bull trout.

Input from project cooperators, the CTWSRO Fish and Wildlife Committee and biometric specialists may slightly alter or change the methodologies or actions proposed within this document.

Objective 1: Identify microhabitat selection of juvenile Chinook salmon, juvenile steelhead trout and Bull trout within Shitike Creek at varying densities.

Methods

To identify microhabitat selection of juvenile Chinook salmon, juvenile steelhead trout (either progeny of steelhead or resident rainbow trout), and bull trout within Shitike Creek, a microhabitat survey will be instituted during summer 2003. To reduce handling of fish and crew effort, snorkeling techniques will be used to collect microhabitat data. Additionally, an abundance estimate of juvenile steelhead trout, juvenile Chinook salmon and Bull Trout will be performed in every habitat unit where microhabitat data is collected.

The microhabitat survey will consist of three or four person crew performing visual observation and enumeration of juvenile Chinook salmon, juvenile steelhead trout and Bull trout in slow and fast-water channel units. Every 3rd juvenile steelhead trout and juvenile chinook

salmon encountered by a snorkeler will be selected for collection of microhabitat data. Only fish not disturbed by the snorkeler will be selected for collection of microhabitat data. The proposed microhabitat survey will measure and institute similar variables measured by Underwood et al. (1995) to determine microhabitat preference (Table 1). Snorkelers will collect a minimum of 10 microhabitat observations on juvenile steelhead trout and juvenile chinook salmon within a fast or slow-water channel unit.

After collection of microhabitat data within a channel unit, a bounded count will be performed by snorkelers using methodologies similar to a previous abundance survey conducted by Dambacher (2001). In this previous juvenile salmonid abundance survey (Dambacher 2001), a number of fast and slow water habitats were identified, snorkeled, and abundance estimates generated for each sampled habitat unit throughout the distribution of juvenile Chinook salmon in Shitike Creek (Table 2 and Figure 1). Based on results of the 2001 abundance survey, a large amount of the juvenile Chinook and juvenile steelhead trout populations occur in slow-water habitat rather than fast-water habitat (Figures 2 and 3). A proposed sampling fraction of slow and fast-water channel units for the proposed microhabitat survey is outlined in Table 2.

Table 1. Microhabitat variables (Underwood et al. 1995) to be collected on randomly selected juvenile steelhead trout, juvenile Chinook salmon, and Bull Trout within Shitike Creek, OR. Variables measured relate to the selected fish or the immediate area the fish inhabits at the time of observation.

Variable	Unit or Category(s)	Description
Species	SST	Steelhead or Rainbow Trout (*Oncorhynchus mykiss*)
	SCS	Spring Chinook Salmon
	BLT	Bull Trout
Age	0+	SCS – Age 0+ ≤ 115 mm
	Post age 0+	SST – Age 0+ ≤ 90 mm Post age 0+ >90 mm
		BLT – Age 0+ ≤ 90 mm Post age 0+ >90 mm
Distance from Streambed	Meters (0.1)	Distance from streambed at the time of snorkel observation.
Most Prevalent Substrate Type	Silt or Fines (<2.0 mm)	From Platts et al. (1984). Estimated from snorkel observation. The snorkel observation crew will be calibrated at start of microhabitat survey on their identification and classification of these substrate categories
	Small Gravel (2.0 – 15 mm)	
	Large Gravel (>15mm – 60mm)	
	Small Cobble (60-130 mm)	
	Large Cobble (120-250 mm)	
	Boulder (>250 mm)NA	
Total Depth	Meters (0.1)	Measured at point of fish location from streambed to surface of water.

Nearest Cover Type	**Boulders** **Undercut Banks** **Turbulence (Bubble Curtain)** **Overhead Vegetation** **Small Woody Debris** **Large Wood Debris**	**From Wesche et al. (1987). Cover type will be determined by snorkel observation of fish for a time of at least one minute.**
Distance to Nearest Cover Type	**Meters (0.1)**	**Visually estimated from snorkel observation.**
Nearest fish Species	**SST** **SCS** **BLT** **Other**	**Steelhead or Rainbow trout** **Spring Chinook Salmon** **Bull Trout** **Other species present within Shitike Creek**
Distance of nearest fish Species	**Meters (0.1)**	**Visually estimated from snorkel observation.**
Grouped or Ungrouped	**G or U**	**In a group of other fish (within 30cm) or not grouped with other fish (> 30cm away from another fish. If grouped with other fish an estimate of the number of fish will be made by the snorkeler and the species composition of that group.**
Water Velocity	**Meters per second (MPS)**	**Measured using Global Water Velocimeter at end of snorkel observation. In an effort not to disturb observed fish, a marker will be placed below the fish and velocity will be measured at the end of snorkel observation and at the conclusion of microhabitat survey in the selected unit.**

Table 2. Total fast water (FW) and slow water (SW) channel units in Shitike Creek, OR during 2001 juvenile abundance survey for reaches 1-5 (Dambacher 2001). Percent composition of each channel unit, for each reach is provided in parentheses. The number of units in each reach for 2001 sampling and 2003 proposed sampling scenarios is also provided.

	Habitat	**Total habitat**			**2001 Sampling (variable %)**	**Previously Proposed 2003 SW=15%**	**Currently proposed 2003 sampling Reaches 1, 3†, 5 SW=15% FW=10%**
Reach	type	N	length (m)	Area (m^2)	n	n	N
1	FW	92	7,429 (74%)	110,695 (78%)	9		9
	SW	81	2,642 (26%)	30,940 (22%)	16	13	13
2	FW	23	2,420 (90%)	30,949 (90%)	2		
	SW	9	277 (10%)	3,297 (10%)	9	2	
3†	FW	75	6,147 (78%)	63,792 (78%)	10		10†
	SW	54	1,756 (22%)	17,666 (22%)	11	9	9†
4	FW	102	14,390 (91%)	162,648 (91%)	13		
	SW	45	1,376 (9%)	15,410 (9%)	8	7	
5	FW	32	2,976 (64%)	35,088 (65%)	4		4
	SW	37	1,669 (36%)	19,068 (35%)	8	6	6
Total	FW	324	33,362 (81%)	403,172 (82%)	38		23
Total	SW	226	7,720 (19%)	86,381 (18%)	52	37	28
Overall		550	41,082	489,553	90	37	51
	Estimated Time for Survey - 1 Person , 10 hrs/day				N/A	30 days*	40 days*
	Estimated Time for Survey - 2 People, 10 hrs/day				N/A	15 days*	20 days*
	Estimated Time for Survey - 3 People, 10 hrs/day				N/A	10 days*	14 days*

* Assumes 4 hours for microhabitat sampling, 2 hours travel time, and 1 hour for bounded counts, and 1 hour hike time for each slow water habitat unit. These estimates do not include travel time for USFWS personnel to and from Vancouver, WA.

† Reach 3 would only be sampled when reaches 1 and 5 have been completed, and if time permits sampling

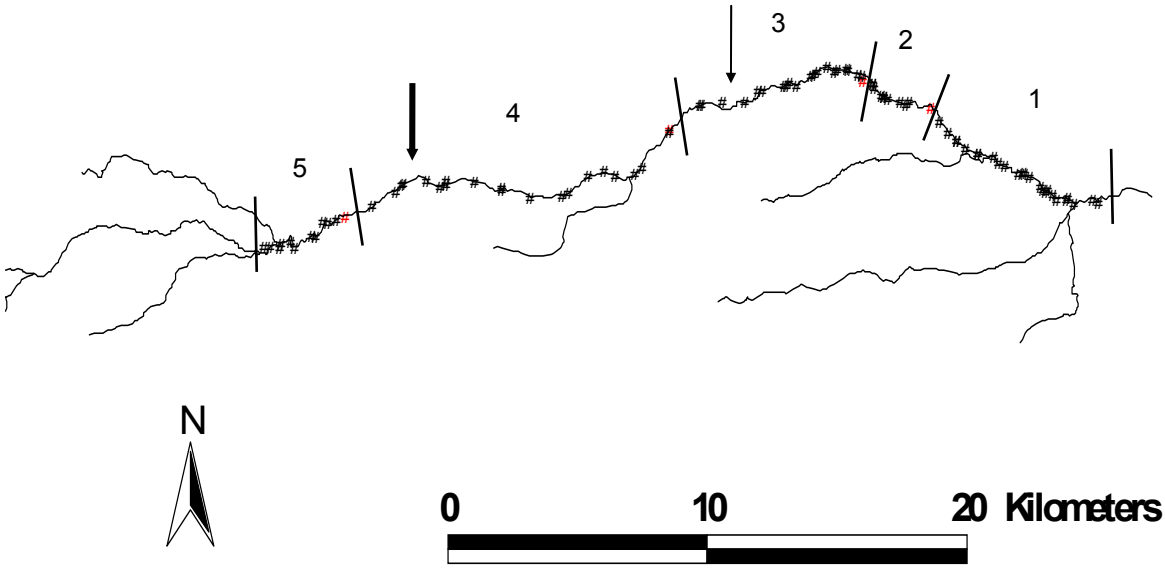

Fig. 1. Shitike Creek basin—tributary of the Deschutes River—in the Confederated Tribes of the Warm Springs Reservation, Oregon. Number and boundaries of each reach used in juvenile Chinook salmon abundance surveys (Dambacher 2001) are denoted. Reach 1 includes the area from the Community Center to Thompson's Bridge. Reach 2 includes Thompson's Bridge to Headworks. Reach 3 includes the area from Headworks to Bennetts. Reach 4 includes the area known as Upper Crossing. Reach 5 is the area from Peters Pasture upstream. The thin arrow denotes observed downstream limit of juvenile bull trout at "Upper Crossing" from Electrofishing conducted by CTWSRO and ODFW personnel in 2000. The thick arrow denotes lower boundary of regular bull trout observations in snorkel-dive counts during 2001. Reproduced from Dambacher (2001).

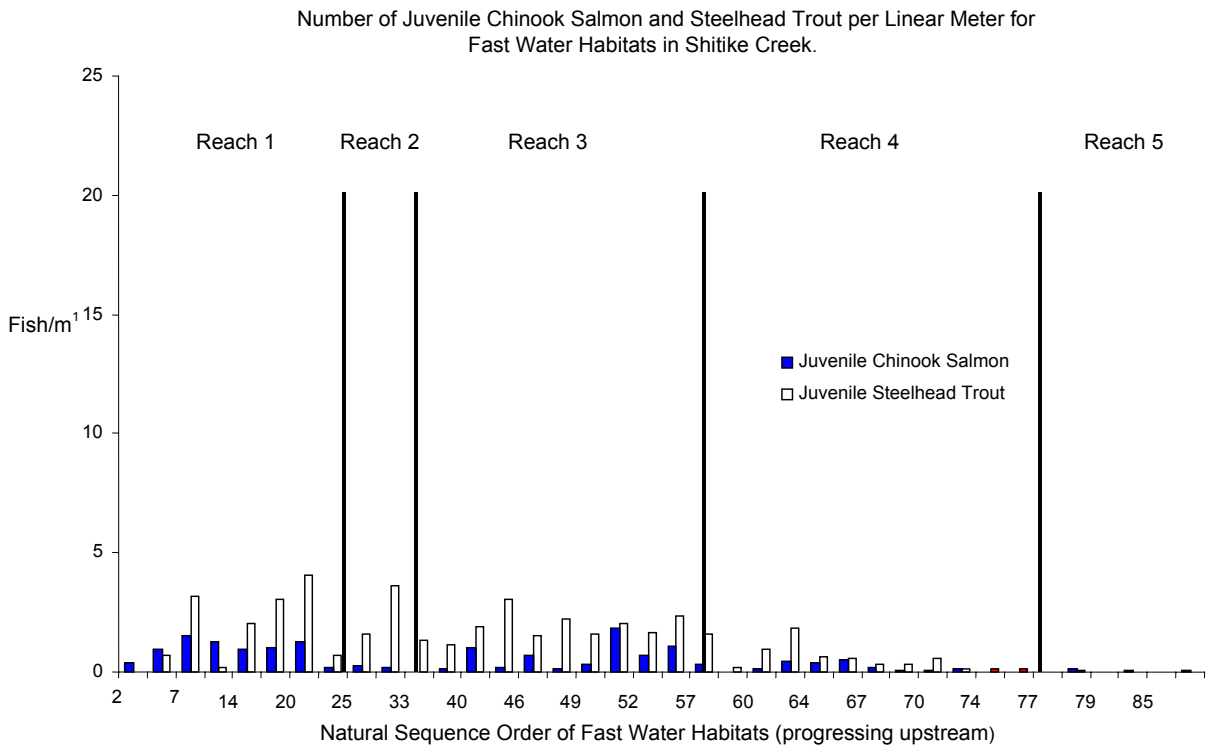

Figure 2. Number of juvenile Chinook salmon and steelhead trout per linear meter of fast water habitat units in Shitike Creek, OR 2001. Reach 1 includes the area from the Community Center to Thompson's Bridge. Reach 2 includes Thompson's Bridge to Headworks. Reach 3 includes the area from Headworks to Bennetts. Reach 4 includes the area known as Upper Crossing. Reach 5 is the area from Peters Pasture upstream. Data presented is from Dambacher (2001).

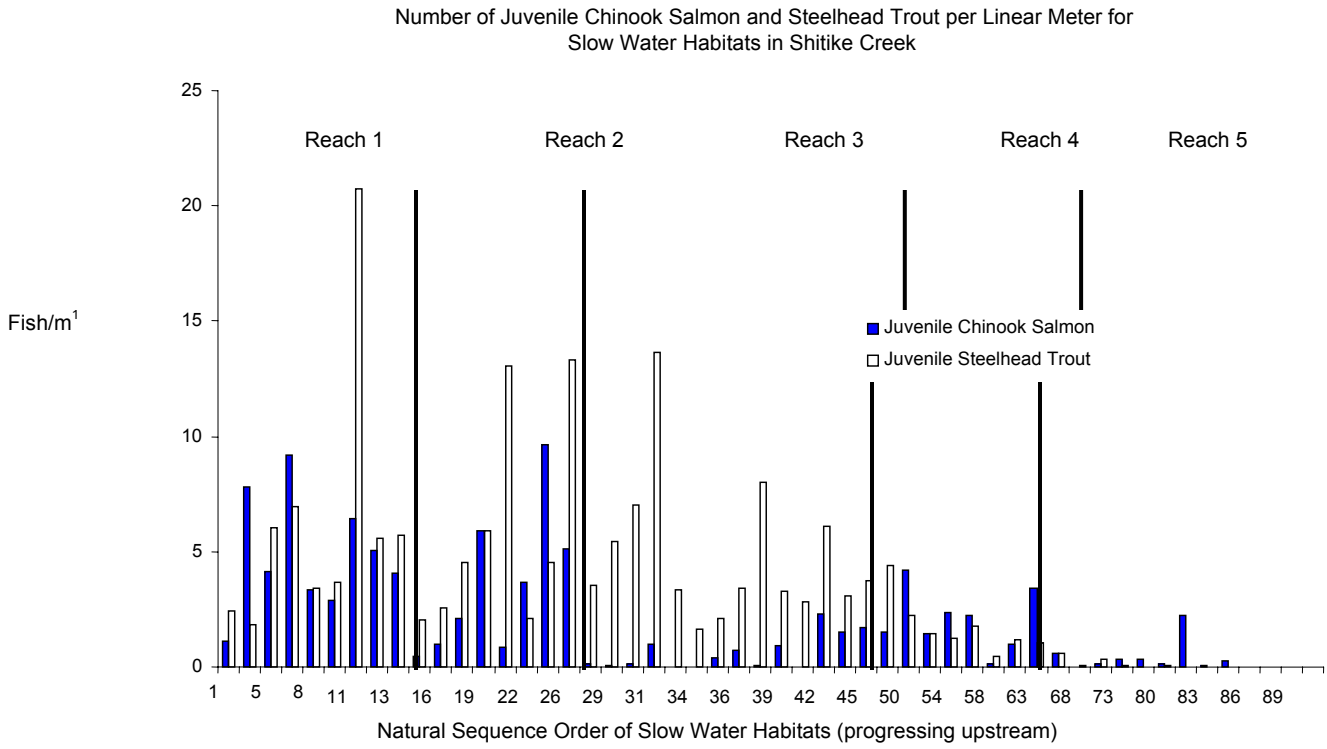

Figure 3. Number of juvenile Chinook salmon and steelhead trout per linear meter of slow water habitat units in Shitike Creek, OR 2001. Reach 1 includes the area from the Community Center to Thompson's Bridge. Reach 2 includes Thompson's Bridge to Headworks. Reach 3 includes the area from Headworks to Bennetts. Reach 4 includes the area known as Upper Crossing. Reach 5 is the area from Peters Pasture upstream. Data presented is from Dambacher (2001).

A change to the past survey abundance methodology used in Shitike Creek by Dambacher (2001) would involve a modification to the bounded counts estimator (Robson and Whitlock 1954; Routledge 1982) used to estimate juvenile fish abundance when performing snorkel counts. The bounded counts estimator is

$$\hat{Y} = X_m + (X_m - X_{m-1})$$

where,

$\hat{Y}$ = abundance estimate for unit
X_m = highest count
X_{m-1} = next highest count

Dambacher (2001) found that in most units sampled for juvenile abundance, only counts made by divers during the first 3 of 4 passes were used in the bounded counts estimator therefore, only 3 passes will be required for snorkelers during the bounded counts to be performed in fast and slow-water units within Shitike Creek during 2003.

Traditionally, validation of a bounded count estimate on a channel unit is conducted using multiple pass electrofishing (Hankin and Reeves 1988). In an effort to calibrate snorkel counts, reduce stress on juvenile fish and conserve man-hours, a new snorkel count calibration method will be instituted using a mark-resight methodology (Table 3). The mark-resight estimate calculated from that snorkel count will be considered the "true" number of juvenile steelhead trout and Chinook salmon within the slow-water unit. A correction factor based on a linear regression of the "true" number against the estimated number from the 3 pass bounded count will be calculated and applied to units where the mark-resight methodology was not performed. Due to handling concerns for Bull Trout and the pending completion of an intra-

Service Section 7 Consultation, only 3 slow-water channel units will be selected for mark-resight calibration. The selected units will occur below the initial juvenile Bull Trout snorkel observation within Shitike Creek during the 2001 (Figure 1).

When microhabitat observation and bounded counts have been completed in a slow water unit, the total length of the unit down the thalweg and three width measurements systematically spaced through the unit will be recorded. Maximum depth at each width measurement will also be noted. Unit dimensions (length, average width, and average depth) will be used to calculate total density within a habitat unit (estimated number of fish/m^3).

Table 3. Proposed mark-resight methodology

Step Number	Procedure	Description
1	Block net unit on up and downstream sections.	Will ensure no immigration or emigration from selected slow-water unit during marking procedure or after marked fish are released back into unit
2	Multiple seine pulls through unit.	At least two pulls of a seine will be attempted in each selected unit to maximize catch for marking.
3	Collected fish will be anesthetized; fork length (mm) and weight (g) of individual fish will be recorded.	Collected fish will be held in perforated buckets within Shitike Creek to maintain adequate flow. Water temperature will also be monitored. Fish will not be marked, measured, or captured in water temperatures that are in excess of 18C, or on days that water temperature could exceed 18C for more than a 2 hour period.
4	Fish will be marked with a solution of Bismarck Brown Y and released.	After fish are anesthetized, measured, and weighed they will be placed in a tub of stream water and Bismarck Brown Y solution. Stream water and Bismarck Brown Y will be mixed to form a 0.007% solution. Fish will placed in the solution for 10 minutes then released back into the slow-water unit. The proposed concentration of Bismarck Brown Y solution and immersion time will illicit a mark retention of approximately 2 days, dependent on water quality. Further trials of mark retention and underwater observation of marked fish is planned at Eagle Creek NFH during late June 2003 and will involve both USFWS and CTWSRO personnel.
5	A three (3) hour block of time will allow marked fish to acclimate.	To meet assumptions of a mark-resight procedure, marked fish must exhibit normal behavior and mix with unmarked fish within the unit.
6	Mark-resight snorkel count will be performed.	Three (3) snorkel observers will conduct an enumeration of marked and unmarked individuals within the slow-water unit to calculate the "true" number of juvenile steelhead trout and Chinook salmon within the unit.
7	Block nets will be removed and correction factor on abundance estimates will be calculated.	Block nets will be removed from the upstream and downstream sections of the slow-water unit to allow immigration and emigration of juvenile salmonids. A correction factor will be calculated using a linear regression of bounded count estimates against mark-resight estimates ("true" number of fish within a unit).

Objective 2: Determine if there is a relationship between microhabitat selection and fish density in slow and fast-water channel units.

Several statistical analyses will be performed to determine relationships between microhabitat preference, fish density and water temperature (Table 4). Statistical analyses are identified in this document but have not been scrutinized and approved by Service Biometric specialists. When statistical analyses have been approved by Service Biometric specialists, project cooperators will be immediately informed and a final document will be provide to project cooperators, the CTWSRO Fish and Wildlife Committee and other interested parties.

Table 4. Hypotheses to be tested, statistical test to be used and alpha level for microhabitat and fish density data collected within Shitike Creek 2003. Analyses may change dependent on review from USFWS biometricians.

Null Hypothesis	Test	Alpha level
Microhabitat preference (velocity, depth, distance to cover etc.) is the same between reaches 1, 3, and 5 for post age 0+ juvenile steelhead trout in fast-water units. A minimum of 10 microhabitat observations per channel unit for juvenile chinook salmon and juvenile steelhead trout combined. Reach 1= 9 fast-water Reach 3 = 10 fast-water Reach 5 = 4 fast-water	ANOVA	$\alpha = 0.05$
Microhabitat preference (velocity, depth, distance to cover etc.) is the same between reaches 1, 3, and 5 for post age 0+ juvenile steelhead trout in slow-water units. A minimum of 10 microhabitat observations per channel unit for juvenile chinook salmon and juvenile steelhead trout combined. Reach 1= 13 slow-water channel units Reach 3 = 9 slow-water channel units Reach 5 = 6 slow-water channel units	ANOVA	$\alpha = 0.05$
Microhabitat preference (velocity, depth, distance to cover etc.) is the same between reaches 1, 3, and 5 for post age 0+ juvenile Chinook in fast-water units. A minimum of 10 microhabitat observations per channel unit for juvenile chinook salmon and juvenile steelhead trout combined. Reach 1= 9 fast-water Reach 3 = 10 fast-water Reach 5 = 4 fast-water	ANOVA	$\alpha = 0.05$
Microhabitat preference (velocity, depth, distance to cover etc.) is the same between reaches 1, 3, and 5 for post age 0+ juvenile Chinook in slow-water units. A minimum of 10 microhabitat observations per channel unit for juvenile chinook salmon and juvenile steelhead trout combined. Reach 1= 13 slow-water channel units Reach 3 = 9 slow-water channel units Reach 5 = 6 slow-water channel units	ANOVA	$\alpha = 0.05$
Microhabitat (velocity, depth, distance to cover etc.) of juvenile steelhead trout is independent of overall fish density and chinook density within each reach. (slope = 0) A minimum of 10 microhabitat observations per channel unit for juvenile chinook salmon and juvenile steelhead trout combined. Reach 1= 13 slow-water channel units Reach 1= 9 fast-water Reach 3 = 9 slow-water channel units Reach 3 = 10 fast-water Reach 5 = 6 slow-water channel units Reach 5 = 4 fast-water	Regression Analysis	$\alpha = 0.05$

Proposed Sampling Schedule and Completion Timeline

Objective	Activity	FY 2003					
		July 7-13	July 14-20	July 21-27	July 28-Aug 3	Aug 4 – Aug 9	Aug 10 – Jan 31, 2004
Identify microhabitat selection of juvenile Chinook salmon, juvenile steelhead trout and Bull trout within Shitike Creek at varying fish densities.	Selection of fast and slow-water units for microhabitat sampling. Possible start of microhabitat surveys.	July 7-8					
Identify microhabitat selection of juvenile Chinook salmon, juvenile steelhead trout and Bull trout within Shitike Creek at varying dish densities.	Possible start of microhabitat surveys.	July 9-11					
Identify microhabitat selection of juvenile Chinook salmon, juvenile steelhead trout and Bull trout within Shitike Creek at varying fish densities.	Microhabitat surveys in slow and fast-water units.		All Week	All Week	All Week	Partial Week	
Determine if there is a relationship between microhabitat selection and fish density in slow and fast-water channel units.							In addition to other assigned duties.

Literature Cited

Dambacher, J.M. 2002. Project report: relative abundance of juvenile Chinook salmon in Shitike Creek, of the Confederated Tribes of the Warm Springs Reservation, Oregon. Oregon Department of Fish and Wildlife, Corvallis Research Lab, Corvallis, OR. 12 pp.

Hankin, D.G., and G.H. Reeves. 1988. Estimating total fish abundance and total habitat area in small streams based on visual estimation methods. Canadian Journal of Fisheries and Aquatic Sciences 45: 834-844.

Robson, D.S. and J.H. Whitlock. 1964. Estimation of a truncation point. Biometrika 51: 33-39.

Routledge, R.D. 1982. The method of bounded counts: when does it work? Journal of Wildlife Management 46: 757-761.

Underwood, K.D., S.W. Martin, M.L. Schuck, and A.T. Scholz. Department of Biology, Eastern Washington University and Washington Department of Wildlife. 1995. Investigations of Bull Trout, Steelhead Trout, and Spring Chinook Salmon interactions in Southeast Washington Streams. Prepared for Bonneville Power Administration − Project Number 90-053.

Attachment D:

Federal and Oregon listing status of wildlife species in the lower Dechutes River subbasin below Pelton Dam (ODFW 2001).

Species	Federal Listing Status	Oregon Listing Status
Amphibians		
Cascade frog *Rana cascadae*	Species of Concern	Sensitive
Northern leopard frog *Rana pipiens*		Sensitive
Northern red-legged frog *Rana aurora aurora*	Species of Concern	Sensitive
Oregon spotted frog *Rana prettosa*	Proposed Threatened	Sensitive
Western toad *Bufo boreas*		Sensitive
Reptiles		
Northern sagebrush lizard *Sceloporus graciosus graciosus*	Species of Concern	
Western pond turtle	Species of Concern	Sensitive
Birds		
American Peregrine falcon *Falco peregrinus anatum*	Endangered	Endangered
Bald eagle *Haltaeetus leucocephalus*	Threatened	Threatened
Bank swallow *Riparia riparia*		Sensitive
Ferruginous hawk *Buteo regalis*	Species of Concern	Sensitive
Harlequin duck *Histrionicus histrionicus*	Species of Concern	Sensitive
Mountain quail *Oreortyx pictus*	Proposed threatened	
Northern goshawk *Acipiter gentilis*	Species of Concern	Sensitive
Northern spotted owl *Strix occidentalis caurina*	Threatened	Threatened
Olive-sided flycatcher *Contopus cooperi*	Species of Concern	

Species	Federal Listing Status	Oregon Listing Status
Tricolored blackbird *Agelaius tricolor*	Species of Concern	Sensitive
Western barrowing owl *Speotyto cunicularia hypagea*	Species of Concern	Sensitive
Mammals		
California bighorn *Ovis Canadensis californiana*	Species of concern	
California wolverine *Gulo gulo luteus*	Species of Concern	Threatened
Pacific fisher *Mertes pennanti pacifica*	Species of Concern	Sensitive
Long-eared myotis *Myotis evotis*	Species of Concern	Sensitive
Long-legged myotis *Myotis volans*	Species of Concern	Sensitive
Pale western big-eared bat *Plecotus townsendii pallescens*	Species of Concern	Sensitive
Pygmy rabbit *Brachlagus idahoensis*	Species of Concern	Sensitive
Small-footed myotis *Myotis cilolabrum*	Sepcies of Concern	Sensitive
Yuma myotis *Myotis yumanensis*	Species of Concern	Sensitive

ADDENDUM A. PROGRAM EFFECTS ON OTHER (AQUATIC OR TERRESTRIAL) ESA-LISTED POPULATIONS. Species List Attached (Anadromous salmonid effects are addressed in Section 2)

15.1) List all ESA permits or authorizations for all non-anadromous salmonid programs associated with the hatchery program.

Intra-Service Section 7 Biological Evaluation Form, July 1998

15.2) Describe USFWS ESA-listed, proposed, and candidate salmonid and non-salmonid species and habitat that may be affected by hatchery program.

The listing status of wildlife species in the lower Deschutes river subbasin is found in Attachment D.

Bull Trout (*Salvelinus confluentus*)

Bull trout in the Warm Springs River and Shitike Creek are part of the Columbia River distinct population segment that was listed as a threatened species in 1998. Bull trout in the Warm Springs River are present in low numbers while bull trout in Shitike Creek are present in moderate numbers (Brun 1999, Brun and Dodson 2000 and 2001). The Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO) are currently conducting population, distribution, and life history surveys for bull trout in the Warm Springs River and Shitike creek. Bull trout in general prefer cold water streams with temperatures below 15 degrees C (Reiman and McIntyre 1993). The majority of bull trout in the Warm Springs River and Shitike Creek exhibit a fluvial life history. Bull trout spawn and rear in the upper reaches of both the Warm Springs River and Shitike Creek, while using the lower portions of each watershed primarily as a migration corridor between the Deschutes River and the spawning areas. A resident adult bull trout population is also present in both the Warm Springs River and Shitike Creek. This segment of the population does not migrate to the Deschutes River but instead spends its entire life in the upper reaches of the Warm Springs River or Shitike Creek (Chris Brun CTWSRO personal communication). Upstream migration of adult bull trout past Warm Springs National Fish Hatchery, located at Rkm 16 of the Warm Springs River, typically occurs from May through July (Table 15.2.1). A similar migration timing occurs in Shitike Creek (Brun and Dodson 2001). Bull trout typically spawn in the fall, with fry hatching out in late winter or early spring. The bull trout studies being conducted by the CTWSRO are expected to provide more information about the life history characteristics of bull trout in the Warm Springs River, Shitike Creek, and Deschutes River.

Downstream migrant traps have been operated in both the Warm Springs River and Shitike Creek. No bull trout have been caught in the Warm Springs River migrant trap since at least the 1980's (Bob Spateholts, CTWSRO, personal communication). Catch of bull trout in the Shitike Creek migrant trap is outlined in Table 15.2.2 (CTWSRO, unpublished data). Surveys conducted by the Oregon Department of Fish

and Wildlife in 2001 found a limited amount of overlap between juvenile spring Chinook and juvenile bull trout in Shitike Creek. The Oregon Department of Fish and Wildlife surveys found relatively low densities of juvenile spring Chinook salmon in the upper sections of Shitike Creek despite a relatively high density (2.7 redds/km) of Chinook redds. Juvenile Chinook salmon were found predominantly in the lower sections of the creek while juvenile bull trout were found primarily in the upper sections. Larger bull trout were found in both the upper and lower sections. Temperature is believed to be one of the factors that segregates juvenile bull trout and juvenile spring Chinook salmon in these stream reaches (Dambacher 2002).

Table 15.2.1. Monthly upstream passage of adult bull trout through the adult fish ladder at Warm Springs National Fish Hatchery. Bull trout numbers were not collected prior to 1993. The total in 2002 includes two bull trout counted after July (CRiS Database 3/6/03).

Year	May	June	July	Total
1993	1	0	0	1
1994	2	0	0	2
1995	1	2	2	5
1996	4	1	0	5
1997	4	3	0	7
1998	3	4	0	7
1999	2	11	0	13
2000	9	18	1	28
2001	22	3	0	25
2002	14	9	5	30

Table 15.2.2. Catch of juvenile bull trout in the Shitike Creek screw trap (Rkm 1), 1999-2002. The trap was operated during varying time periods between years making it difficult to infer trends. Most bull trout caught after 7/1 were caught in October or November (CTWSRO data).

Year	Prior to July 1	After July 1	Total
1999	48	9	57
2000	36	3	39
2001	70	43	113
2002	26	5	31

15.3) Analysis of effects.

Bull Trout (*Salvelinus confluentus*)

Hatchery Operations (Warm Springs River):

-Ladder and Upstream Passage Facilities

Incidental take of bull trout could occur through activities associated with the Warm Springs NFH adult collection facility and hatchery operations. A fish barrier dam, adjacent to the hatchery, blocks upstream passage of all fish and directs them into a fish

ladder located at the hatchery. Upon entering the fish ladder, fish are either directed into holding ponds or passed upstream through a fish ladder and around the barrier dam. An automated fish passage system is used during the spring Chinook salmon migration period, generally from May through the end of September. The automated passage system is designed to minimize handling of wild fish by passively separating returning hatchery spring Chinook salmon, identified by coded-wire tags, from wild fish. The passage system uses a 15-foot long denil steeppass fish-way with a coded-wire tag tube detector and gate. As fish swim through the fish-way and tube detector, coded-wire tagged fish are detected and a gate opens that shunts them into a holding pond. Non coded-wire tagged fish do not trigger the gate and are able to continue migrating up through the fish ladder and upstream of the barrier dam. A video system records non-coded wire tagged fish as they pass upstream of the hatchery. The video system allows hatchery personnel to monitor the number, species, and origin of fish passing upstream. During operation of the automated passage system, wild fish are not handled by hatchery personnel, thereby reducing the potential take of wild and listed species. Migrational delay as fish find their way into the fish ladder and through the passage system, rejection of the fish ladder resulting in displaced spawning, and injuries suffered as adults try to jump the barrier dam could result in the incidental taking of adult bull trout.

The automated passage system is only used during the spring Chinook salmon migration period, generally from 15 April to 30 September. The proper functioning of the passage system relies on 100% coded-wire tagging of hatchery fish, with all non coded-wire tagged fish passed upstream. If the passage system allows too many hatchery spring Chinook salmon upstream (approximately 10% of the wild population), the passage system is shut down and fish are sorted by hand. All spring Chinook salmon juveniles released from Warm Springs NFH are coded-wire tagged but stray hatchery fish from hatcheries outside the subbasin may not be coded-wire tagged. The Warm Springs River, and the Deschutes River subbasin in general, has a high incidence of stray hatchery steelhead (Olson and Pastor 1998). In order to preserve the genetic integrity of wild steelhead in the Warm Springs River, it is the policy of Warm Springs NFH to pass only wild (unmarked) steelhead above the barrier dam. In order to accomplish this goal, the automated fish passage system is not used until the steelhead migration has ended, usually sometime in late April. During the steelhead migration period or during other times when the passage system is not operating, fish find their way into the fish ladder and are diverted into a holding pond. In the mornings, hatchery personnel hand sort the fish. Fish are anesthetized with MS-222 or CO_2, sorted, and measured. All wild summer steelhead, bull trout, and other indigenous fish species are then passed upstream while hatchery spring Chinook and some wild spring Chinook are passed into brood holding ponds. During times when the automated passage system is not operating, adult bull trout may be held in the holding ponds for 24 to 72 hours until sorting and passage upstream. When high numbers of fish are migrating up the fish ladder, hatchery personnel sort on a daily basis. During times of low fish numbers, the ponds are sorted Monday through Friday. During times of the year when steelhead or spring Chinook salmon are not migrating, approximately October through early February, the fish ladder is left open and fish are able to swim upstream without being diverted into the hatchery.

Prior to 1991, some adult bull trout that entered the fish ladder during the steelhead and spring Chinook salmon spawning migration were removed from the fish ladder and killed at the hatchery. While records of bull trout entering the fish ladder prior to 1993 are unreliable, discussions with Service and CTWSRO biologists indicate that some bull trout were intentionally killed while most were passed upstream (Brian Cates, USFWS, personal communication). The number of adult bull trout that were intentionally removed from the fish ladder is estimated to be between zero and three fish per year. Hatchery operation plans since 1991 have recognized bull trout as an important species and have identified the need to pass all native fish upstream of the hatchery. The number of adult bull trout counted at the fish ladder at the hatchery has increased from one fish in 1993 to thirty fish in 2002 (Table 15.2.1). All bull trout entering the hatchery are now passed upstream. While unintentional lethal take at the hatchery could occur as a result of mishandling or mechanical malfunctions associated with the sorting process, no lethal take of bull trout has been recorded at the hatchery since 1993, the first year of reliable records (CRiS database 3/6/03). Take Table 3 outlines a worst case scenario of the lethal take of one adult bull trout per year as a result of mishandling or mechanical failures at the hatchery. If the automated passage system is not being operated, fish may be held in the holding ponds for up to 72 hours before sorting, potentially resulting in a delay of the upstream migration of bull trout. Again, no mortalities of bull trout have been recorded at the hatchery since 1993 and records prior to 1993 are intermittent.

-Hatchery Water Supply (Warm Springs River)

The water source for the hatchery is the Warm Springs River. All water rights on the Warm Springs River are the property of the CTWSRO. Non-consumptive water use is included in the business lease between the CTWSRO and the USFWS. The intake structure and pumps are located at the hatchery site just upstream of the barrier dam. Water is pumped from the reservoir behind the barrier dam. Water is pumped to the hatchery ponds after passing through a trash rack and a traveling screen. Directly in front of the traveling screen is a fish bypass which is designed to divert small fish away from the screen and below the barrier dam. The Integrated Hatchery Operations Team noted that the current 3/16th inch mesh does not meet the 1/10th inch standard for screening facilities (IHOT 1996). It is suspected that juvenile fish are entering the hatchery ponds through the intake structure at the hatchery. Juvenile steelhead (or juvenile rainbow trout), lamprey ammocoetes, and sucker sp. have been observed in the rearing ponds. No bull trout have been recorded in the rearing ponds. The Warm Springs NFH Implementation Plan (CTWSRO and USFWS 2002) identifies the need to replace the water intake structure to meet NOAA Fisheries Hatchery Biological Opinion criteria. Money has been identified to begin design and engineering of modified screens for the intake structure in 2003. Contingent on acquiring the necessary permits and completing consultation, installation of the new screens is expected in 2004.

-Hatchery Effluent (Warm Springs River)

Hatchery effluent goes directly to the river during normal operations. During pond cleaning, the hatchery effluent goes through a primary treatment process (settling pond) before discharge to the Warm Springs River. The settling pond is 11 acre feet in size and the water has a residence time of approximately five days. Hatchery effluent monitoring meets the National Pollution Discharge Elimination Permit; however fish health pathogens are not monitored in the effluent.

<u>Monitoring and Evaluation</u> (Warm Springs River):

-Downstream Migrant Trapping (Warm Springs River)

Monitoring activities associated with the Warm Springs also have the potential for incidental take of bull trout. In 2002, the CTWSRO installed two rotary screw traps at approximately Rkm 5 of the Warm Springs River. The rotary screw traps are on loan from the Service and are operated by CTWSRO personnel. Prior to 2002, a Humphrey trap was used to collect juvenile downstream migrants. The screw traps are operated in order to gather outmigration timing and population estimates for juvenile spring Chinook salmon. The trap has typically been operated from mid-March through mid-November. As part of an increased monitoring effort, the CTWSRO anticipate operating the trap from January through November. During this time period the traps are typically operated Monday through Friday. During the peak spring Chinook migration periods (April-May, October-November), the traps may be operated seven days a week. Whenever the traps are in operation, they are checked daily between 7:00 a.m. and 10:00 a.m. Juvenile spring Chinook salmon collected at the trap are anesthetized with MS-222, measured, weighed, and a subsample are marked by clipping a small portion of the caudal fin. The marked fish are then released upstream for mark-recapture population estimates. The probability of capture for juvenile bull trout in the screw trap is low. No juvenile bull trout have been trapped in the smolt trap on the Warm Springs River (Bob Spateholts, CTWSRO, personal communication). Although it is unlikely, juvenile bull trout trapped at the Warm Springs River migrant trap could potentially be subjected to unintentional lethal take through mishandling during trapping or handling. If juvenile bull trout are collected at the trap they will be anesthetized with MS-222, weighed, measured, marked, and released upstream. Take Table 3 outlines a scenario in which less than 4 juvenile bull trout may be trapped in the rotary screw trap per year.

-Redd Surveys (Warm Springs River)

Spring Chinook salmon redd surveys are conducted by Tribal and Service personnel in late August and early September on 14 index reaches of the Warm Springs River, Mill Creek, and Beaver Creek. During the redd surveys two person teams walk down the stream counting live fish, dead fish, and spring Chinook redds. Anywhere from two to four passes of each survey site, spaced about a week apart, are conducted each year. The redd surveys help fish managers estimate prespawning mortality, spawn

timing, and spawning locations of wild and hatchery spring Chinook. It is possible that some bull trout may be temporarily displaced as surveyors walk downstream. The impact to bull trout is expected to be minimal since most of the spring Chinook index reaches are in areas where water temperatures are higher than the preference for bull trout spawning (see Figure 1). Bull trout, and bull trout redds, have been observed in limited numbers during the spring Chinook redd surveys (Bob Spateholts, CTWSRO). One spring Chinook redd survey index reach, Bunchgrass to Schoolie (at approximately Rkm 52), is in an area where bull trout are known to spawn (Brun and Dodson, 2001).

-Snorkel Surveys (Warm Springs River)

Tribal and Service personnel will conduct index snorkel surveys in the Warm Springs River in order to monitor population trends of juvenile fish, particularly spring Chinook salmon. Index reaches in the Warm Springs River, Mill Creek, and Beaver Creek will be snorkeled during July and August. During snorkeling in 2002, two juvenile bull trout observed in the Schoolie index reach. No other bull trout were found during the spring Chinook snorkelling. Snorkelers will visually estimate the number of juvenile fish in a given index reach by using a three-pass method described in Dambacher 2002. During the snorkel surveys, block nets will be placed at the upstream and downstream ends of the reach, preventing any immigration or emigration of fish during the survey. Once snorkelers have completed their three passes, the block nets will be removed. Impacts to bull trout during the abundance surveys is expected to be limited to temporary displacement as snorkelers work their way up through a unit. In certain reaches, snorkelers estimates will be calibrated using a mark-resight technique. In the calibration reaches, block nets will be placed at the upstream and downstream ends of the reach, preventing any immigration or emigration during the snorkeler calibration. After snorkelers have completed their three passes, a portion of the juvenile fish in the reach will be collected using a seine. Fish that are seined will be placed in buckets containing a mixture of stream water and Bismark brown for approximately five minutes (Ewing, et al. 1990). The Bismark brown produces a temporary discoloration of the fish. The fish will then be released back into the index reach. Snorkelers will re-snorkel the reach, counting the number of "marked" fish. Calibration surveys will not be done in areas where bull trout are found.

Adult Outplanting (Shitike Creek)

In the late summer of 2000, the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO) initiated an adult spring Chinook salmon (*Oncorhynchus tshawytscha*) outplanting program in Shitike Creek, a tributary of the Deschutes River contained entirely within the CTWSRO Reservation. Shitike Creek flows approximately 61km from its headwaters near Mt. Jefferson before entering the Deschutes River (Rkm 174). Shitike Creek and the Warm Springs River are the only tributaries of the Deschutes River that currently support successful natural spawning of spring Chinook salmon. The adult spring Chinook salmon outplanting program is intended to boost the spawning population of spring Chinook salmon in Shitike Creek by

allowing adult hatchery spring Chinook salmon from Warm Springs NFH to spawn naturally in the creek.

Warm Springs NFH has a broodstock collection goal of 630 spring Chinook salmon for hatchery operations and 200 spring Chinook salmon for the outplanting program. Returning hatchery fish are collected for broodstock and outplanting proportionately throughout the run based on wild Warm Springs River stock run timing (Warm Springs NFH Operational Plan 2002-2006). During spawning days at the hatchery, usually in late August and early September, the CTWSRO loads fish for outplanting into an aerated tank truck and hauls them to one of five sites on Shitike Creek (Figure 2). The hatchery fish are released into the stream and are allowed to spawn naturally. The life history characteristics of hatchery spring Chinook salmon from Warm Springs NFH is consistent with what has been observed for the naturally spawning spring Chinook salmon in Shitike Creek. The outplanting of adults from Warm Springs NFH is not expected to produce a new, separate stock of spring Chinook salmon.

On 31 August 2000, the CTWSRO began outplanting adult hatchery spring Chinook salmon from Warm Springs NFH into Shitike Creek. In 2000, a total of 159 spring Chinook were outplanted at five sites throughout Shitike Creek (Figure 2). The five outplanting sites were selected by the CTWSRO based on access considerations and available spawning habitat. The outplant sites are Thompson's Bridge (Rkm 6.5), Headworks (Rkm 9.2), Bennetts (Rkm 12.7), Upper Crossing (Rkm 16.6), and Peter's Pasture (Rkm 40). The goal of the outplanting program is to annually outplant 200 spring Chinook salmon into Shitike Creek, although the actual number outplanted has varied according to returns to Warm Spring NFH and broodstock needs at the hatchery (Table 15.3.1).

Table 15.3.1. Number of hatchery spring Chinook salmon outplanted into Shitike Creek.

Year	Male	Female	Total
2000	49	110	159
2001	75	123	198
2002	63	20	83

The impacts to native populations in Shitike Creek from the outplanting program are not known. Juvenile populations of bull trout in Shitike Creek are primarily limited to areas with temperatures below 15 degrees Celsius. Spawning and rearing of juvenile bull trout occurs above the Upper Crossing area (Rkm 16.6) with most rearing taking place in the Peter's Pasture (Rkm 40) area. During surveys in 2001, the downstream boundary for juvenile bull trout collected during electro-fishing was in the Upper Crossing area while the downstream boundary for juvenile bull trout observed during snorkel surveys was just below the Peter's Pasture area at approximately Rkm 30 (Dambacher 2001). Potential impacts from outplanting hatchery spring Chinook salmon on listed bull trout in these areas could include disease transmission from outplanted hatchery fish to native stocks, increased competition for food and habitat among juvenile populations, and an increased forage base for adult bull trout.

Outplanting Warm Springs NFH spring Chinook into Shitike Creek is not expected to pose a significant risk of introducing new pathogens into the stream since there are currently no barriers to migration of fish from the Deschutes River and Shitike Creek (Bob Spateholts, CTWSRO, pers.comm). Diseases which are present at varying levels in Warm Springs NFH spring Chinook include Infectious Hematopoetic Necrosis Virus (IHNV), Bacterial Kidney Disease (BKD), Ichthyophthiriasis (Ich), and Furunculosis. Both IHNV and BKD are widespread in the Deschutes River drainage and are carried by wild Chinook, steelhead, and bull trout. The level of Ich and Furunculosis in wild populations in the Deschutes River is not known. Hatchery spring Chinook salmon returning to Warm Springs NFH in 2002 were found to have high levels of Ich and Furunculosis, resulting in a large die-off of fish held in the hatchery brood ponds. Due to the die-off and concerns about disease transmission into bull trout areas, the CTWSRO restricted outplanting to the three lower sites in Shitike Creek (Bennetts, Headworks, and Thompson's Bridge). Proposals to monitor disease levels in Shitike Creek are currently being developed by the Service and the CTWSRO.

Increased production of spring Chinook salmon in Shitike Creek may alter the fish dynamics between spring Chinook, steelhead, resident rainbows, and bull trout. Increasing juvenile abundance of spring Chinook may lead to increased competition for food or habitat in areas where the species overlap. Conversely, juvenile spring Chinook may provide a forage base for adult bull trout. Tribal snorkel surveys have documented predation on juvenile spring Chinook by adult bull trout (Bob Spateholts, CTWSRO, pers.comm.).

The Service and the CTWSRO have implemented a monitoring and evaluation program that is designed to evaluate the ecological interactions between spring Chinook salmon and other species in Shitike Creek. The objectives of the monitoring and evaluation program are to 1) evaluate the contribution of outplanted spring Chinook salmon to the natural production in Shitike Creek, and 2) investigate the potential ecological interactions of spring Chinook, bull trout, and summer steelhead in Shitike Creek. The full study proposal is found in Attachments B and C. Potential impacts to bull trout from the activities associated with the monitoring program are discussed in the following paragraphs.

<u>Monitoring and Evaluation</u> (Shitike Creek):

-Adult Weir (Shitike Creek)

As part of the monitoring program, adult spring Chinook salmon will be sampled at a temporary weir located near the mouth of Shitike Creek, at approximately Rkm 1. The temporary weir has been operated by the CTWSRO as part of a bull trout monitoring program funded by the Bonneville Power Administration. The Bonneville Power Administration obtained a Section 10 permit from the Service (permit # TEO317151-1)

for the bull trout program covering the operation of the weir and other bull trout monitoring activities from 7/25/01 to 7/24/05. Operation of the weir and sampling in Shitike Creek was also addressed in the Tribal Integrated Resource Management Plan. The weir was typically installed in April or early May, after the main upstream migration of adult summer steelhead. Adult fish migrating upstream were trapped in a live box at the weir and sampled by CTWSRO personnel. Sampling included taking length measurements and scale samples. Fish were then passed upstream of the weir. The CTWSRO bull trout study operated the weir on an intermittent basis from 1999 through 2002. As part of the spring Chinook outplant monitoring program, the weir will be operated by the CTWSRO spring Chinook program starting in 2003. The weir will be installed in March or April and will consist of a series of pickets blocking the stream with an upstream and downstream live box to trap and hold fish as they move past the weir. Pickets will be placed in the weir on Monday mornings and will be removed on Friday evenings to allow fish to pass unimpeded during the weekends. The weir will be removed after the spring Chinook migration. The live boxes will be checked in the mornings and afternoons and water temperatures will be monitored (see Section 15.4). Spring Chinook salmon will be anesthetized with MS-222. Fin-clips, scale samples, and length information will be collected from all upstream migrating spring Chinook. In addition, all spring Chinook will be floy-tagged and opercale punched in order to facilitate a mark-recapture population estimate based on carcass recoveries and redd surveys. Bull trout and steelhead will not be anesthetized but will be enumerated and passed in the direction of migration. Operation of the weir is expected to continue until 2006. Incidental take of adult bull trout may occur at the weir as a result of handling stress, stress from confinement in the live box, or delayed migration as they try to their way through the weir. Unintentional lethal take of adult bull trout at the weir (resulting from stress, high water temperatures, or mishandling) is expected to be minimal (see Take Table 4). The CTWSRO bull trout program operated the weir from 1999-2002. The highest number of bull trout trapped at the weir occurred during 2001, with 80 adult bull trout trapped. The weir was operated seven days a week during the bull trout migration period, mid-May through early July (Brun and Dodson 2001). Based on these numbers, a high end estimate of 100 adult bull trout per year are expected to be trapped during the five day a week weir operations in 2003 and beyond. Actions taken at the weir to minimize take on bull trout are discussed in Section 15.4.

-Downstream Migrant Trapping (Shitike Creek)

Juvenile sampling of downstream migrating fish occurs at a rotary screw trap located near the mouth of Shitike Creek in the town of Warm Springs. The CTWSRO operates the trap as part of the spring Chinook salmon monitoring program and Bonneville Power Administration funded bull trout and Pacific lamprey studies. Again, the Bonneville Power Administration obtained a permit for the screw trap operation from the Service (permit # TEO37151-1). The CTWSRO would like to operate the trap from January through November, should flows be sufficient. During the months of July and August, flow may drop below the level necessary to rotate the screw mechanism on the trap. If this is the case, the CTWSRO will raise the cone on the trap and discontinue trapping until flows rise again. Procedures for operating the Shitike Creek screw trap are

the same as for the Warm Springs River screw trap. The monitoring program in Shitike Creek will collect tissue samples (fin clips) from approximately 1000 juvenile spring Chinook salmon captured at the trap. Since the screw trap is being run as part of the bull trout and Pacific lamprey studies, no additional take of listed species is anticipated as a result of the spring Chinook sampling. Past trapping activities on Shitike Creek have caught up to 113 juvenile bull trout per year (Table 15.2.2). Combining all activities (bull trout studies, lamprey studies, and spring Chinook studies) at the screw trap, a maximum unintentional lethal take of one juvenile bull trout is expected (Take Table 4).

-Juvenile abundance and behavioral surveys (Shitike Creek)

The USFWS and the CTWSRO will also conduct snorkel surveys and juvenile sampling in Shitike Creek during July and August. Snorkel surveys will collect observational data on microhabitat preference, species association, and species interaction for juvenile salmonids and resident trout. Snorkelers will enter a habitat unit and randomly select juvenile fish for observation. Microhabitat measurements such as focal depth, cover type, substrate type, and distance to shore will be taken for each observed fish. During microhabitat measuring fish are expected to be temporarily displaced from their holding area as a result of their predator avoidance instinct (see Take Table 4). Snorkelers will not handle any fish during the microhabitat surveys. The Service and the CTWSRO will also conduct juvenile abundance surveys in sections of Shitike Creek. Abundance surveys will take place in small (<100m) pool-riffle units and will follow a modification of the methods used by Dambacher 2002. Block nets will be set up at the upstream and downstream ends of each unit to prevent movement out of the unit during the survey. Snorkelers will visually count all species in each unit during three passes through the unit. Once the three passes are complete, the block nets will be removed and snorkelers would head to the next unit. No juvenile fish will be handled during the surveys. Calibration of the snorkelers will take place in a subsample of the reaches using the same methods as in the Warm Springs River. During snorkeling in 2002, 121 juvenile bull trout were observed. Of this total, 103 of the bull trout were observed in the Peter's Pasture area (Bob Spateholts, CTWSRO, personal communication). Calibration surveys will not be conducted in areas with a high abundance of bull trout. In addition, no bull trout will be marked with Bismark brown.

-Spring Chinook redd surveys and radio-telemetry (Shitike Creek)

The Service and CTWSRO will conduct spring Chinook salmon redd surveys on approximately seven index reaches in Shitike Creek during late August and early September in order to estimate the total spawning population. Redd surveys will follow the same methods as in the Warm Springs River. Bull trout may be temporarily displaced during the surveys although few bull trout have been observed during past surveys (Bob Spateholts, CTWSRO, personal communication). One of the seven index reaches, the Peter's Pasture reach at approximately Rkm 40, is in an area in which bull trout known to spawn (Brun and Dodson, 2001).

In addition to the redd surveys, outplanted hatchery spring Chinook will be monitored using radio telemetry. A full description of the telemetry study can be found in Attachment B. Service and CTWSRO personnel will track movements and behavior of radio-tagged spring Chinook salmon in Shitike Creek during the spring Chinook spawning period (late August-September). Biologists will be walking up and down the stream during the radio-telemetry study and may temporarily displace bull trout. Displacement is expected to be minimal since the majority of areas where spring Chinook spawn in Shitike Creek are downstream of preferred bull trout habitat (see Figure 1).

Bald eagle *Haltaeetus leucocephalus*

The potential effect of hatchery operations on bald eagles is not known at this time. Eagles have been observed feeding on adult spring Chinook salmon in Shitike Creek (Bob Spateholts, CTWSRO Warm Springs, personal communication). Hatchery produced fish are likely part of the food source for eagles in the Warm Springs and Deschutes River subbasins. The effects of feeding on fish that may contain small amounts of MS-222, erythromycin, or other chemicals used at the hatchery are not known. Bald eagles in the Warm Springs recovery zone have shown an increasing trend in productivity during the past five years, with a productivity rate in 2002 of 1.11 young per occupied nest (Frank Isaacs, Oregon State Cooperative Fish and Wildlife Research Unit, personal communication).

15.4 Actions taken to minimize potential effects.

Hatchery Operations (Warm Springs River):

-Ladder and Upstream Passage Facilities

On-site hatchery operations and procedures are designed to minimize potential effects on listed species. The number of adult bull trout migrating up through the hatchery fish ladder has been increasing (see Table 15.2.1). Use of the automated fish passage system is expected to minimize handling stress and migration delay for wild fish, including adult bull trout. The automated passage system is generally operated from April 15 to September 30, during which time the majority of adult bull trout are migrating upstream past the hatchery (see table 15.2.1). When the automated system is not used, fish entering the fish ladder are sorted by hand (see Section 15.3). Hatchery personnel attempt to minimize handling stress on fish by following the appropriate fish handling guidelines and minimizing the amount of time fish are out of the water.

-Hatchery Water Supply (Warm Springs River)

The need to modify the screen on the water intake structure at the hatchery in order to meet NMFS Hatchery Biological Opinion criteria has been identified in the

Warm Springs NFH Operational Plan and Implementation Plan (CTWSRO and USFWS 2002). Design and engineering of new intake screens is expected to begin in 2003 with construction of the screens completed by 2004.

-Hatchery Effluent (Warm Springs River)

Hatchery effluent currently meets the National Pollution Discharge Elimination Permit. Hatchery staff regularly measure various water quality standards. Total suspended solids and settleable solids in the effluent are sampled once per week during the heaviest load months of March, April, September, and October. In-hatchery water temperatures are monitored daily and in-hatchery dissolved oxygen, nitrogen, ammonia, and pH are regularly checked. Although the effluent is not currently monitored for fish pathogens, the Lower Columbia River Fish Health Center's Wild Fish Survey intermittently samples fish populations in the Warm Springs River.

<u>Monitoring and Evaluation</u> (Warm Springs River):

-Downstream Migrant Trapping (Warm Springs River)

Incidental take of bull trout may occur as a result of the monitoring and evaluation activities associated with Warm Springs NFH. Sampling procedures at the juvenile trap on the Warm Spring River are designed to minimize stress and potential take of listed species. The trap is checked regularly (at least daily) in order to minimize the amount of time fish are held at the trap. When the traps are not fished, the cones are raised to prevent any fish from entering the trap. The amount of time fish are under anesthetic is carefully monitored and fish are allowed sufficient time to recover before being released back into the river. Water temperatures are monitored and the traps are checked in the morning hours when water temperatures are the lowest. Direct take of listed species at the screw trap could occur as a result of trap malfunction or predator intrusion. The CTWSRO have observed mink predation on fish held in the screw trap (Bob Spateholts, CTWSRO Warm Springs, personal communication). During periods of high flows debris may clog the rotary screw mechanism or live box, possibly resulting in descaling or wounding of fish in the trap. Daily monitoring of the trap is expected to minimize take associated with trap malfunction or predator intrusion. If high flows are anticipated, the trap is raised in order to reduce the likelihood of trap malfunction.

-Redd Surveys (Warm Springs River)

The majority of spring Chinook redd survey index reaches in the Warm Springs River watershed are not preferred bull trout habitats, with the exception of the Schoolie index reach at Rkm 52. During the spring Chinook redd surveys, surveyors will attempt to minimize the time walking in the stream and will avoid walking on potential bull trout redds.

-Snorkel Surveys (Warm Springs River)

The majority of the index snorkel survey reaches are in non-preferred bull trout habitat (see Figure 1). Snorkeler calibration will not take place in any area where bull trout are observed. Snorkel surveys will primarily occur during the daytime and care will be taken to minimize disruption to juvenile bull trout. Snorkel surveys will be used in place of electrofishing to estimate juvenile abundance.

<u>Monitoring and Evaluation</u> (Shitike Creek):

-Adult Weir (Shitike Creek)

Actions taken to minimize impacts to bull trout at the adult weir are expected to minimize the risk of take of bull trout. The weir operations were permitted by the Service for the Bonneville Power Administration's bull trout study (permit # TEO37151-1). The weir will only be operated Monday through Friday, allowing bull trout to move upstream unimpeded during the weekends. When the weir is operated, the live box at the weir will be checked twice a day, in the morning and in the early evening, in order to reduce the holding time of adult fish trapped in the live boxes. Water temperatures will be checked every morning and periodically throughout the day. If water temperatures rise above the upper limit of bull trout preference (approximately 17 degrees C) pickets in the weir will be raised to allow fish to move upstream without entering the live box. Pickets may be reinstalled during the evening and night if water temperatures drop below the upper limit of bull trout preference. Bull trout will not be anesthetized for sampling, instead only lengths will be taken and then all bull trout will be immediately passed upstream. Snorkelers will periodically check the downstream end of the weir in order to determine if fish are avoiding the entrance to the trap and delaying upstream migration. The weir design may be modified if trap avoidance is suspected. If design modifications do not alleviate trap avoidance, pickets in the weir will be removed to allow for upstream passage.

-Downstream Migrant Trapping (Shitike Creek)

Procedures to minimize take at the screw trap on Shitike Creek are similar to those on the Warm Springs River. Again, the Service permitted migrant trapping as part of the Bonneville Power Administration's bull trout studies (permit # TEO37151-1). The trap is checked regularly in order to minimize the amount of time fish are held at the trap. The amount of time fish are under anesthetic is carefully monitored and fish are allowed sufficient time to recover before being released back into the river. Water temperatures are monitored and the traps are checked in the morning hours when water temperatures are the lowest. Direct take of listed species at the screw trap could occur as a result of trap malfunction or predator intrusion. During periods of high flows debris may clog the rotary screw mechanism or live box, possibly resulting in descaling or wounding of fish in the trap. Daily monitoring of the trap is expected to minimize take associated with trap

malfunction or predator intrusion. If high flows are anticipated, the trap is raised in order to reduce the likelihood of trap malfunction.

-Juvenile abundance and behavioral surveys (Shitike Creek)

Snorkel surveys will be used to estimate fish abundance in place of more intrusive methods such as electrofishing. During the abundance surveys no fish will be handled, visual observations will substitute for an actual count. Block nets will only be used during the actual surveys and will be removed as soon as the three-passes are completed. Calibration surveys will be limited to areas where there is a low abundance of bull trout. No bull trout will be used for the mark-resight calibrations.

-Spring Chinook redd surveys and radio-telemetry (Shitike Creek)

Spring Chinook redd surveys primarily take place in the lower section of Shitike Creek, areas where water temperatures and habitat limit bull trout distribution. One area where the redd surveys overlap is in the Peter's Pasture area (see Figure 1). During redd surveys, personnel will avoid walking on or near bull trout redds. During the radio-telemetry surveys, care will be taken to limit stream walking in bull trout areas.

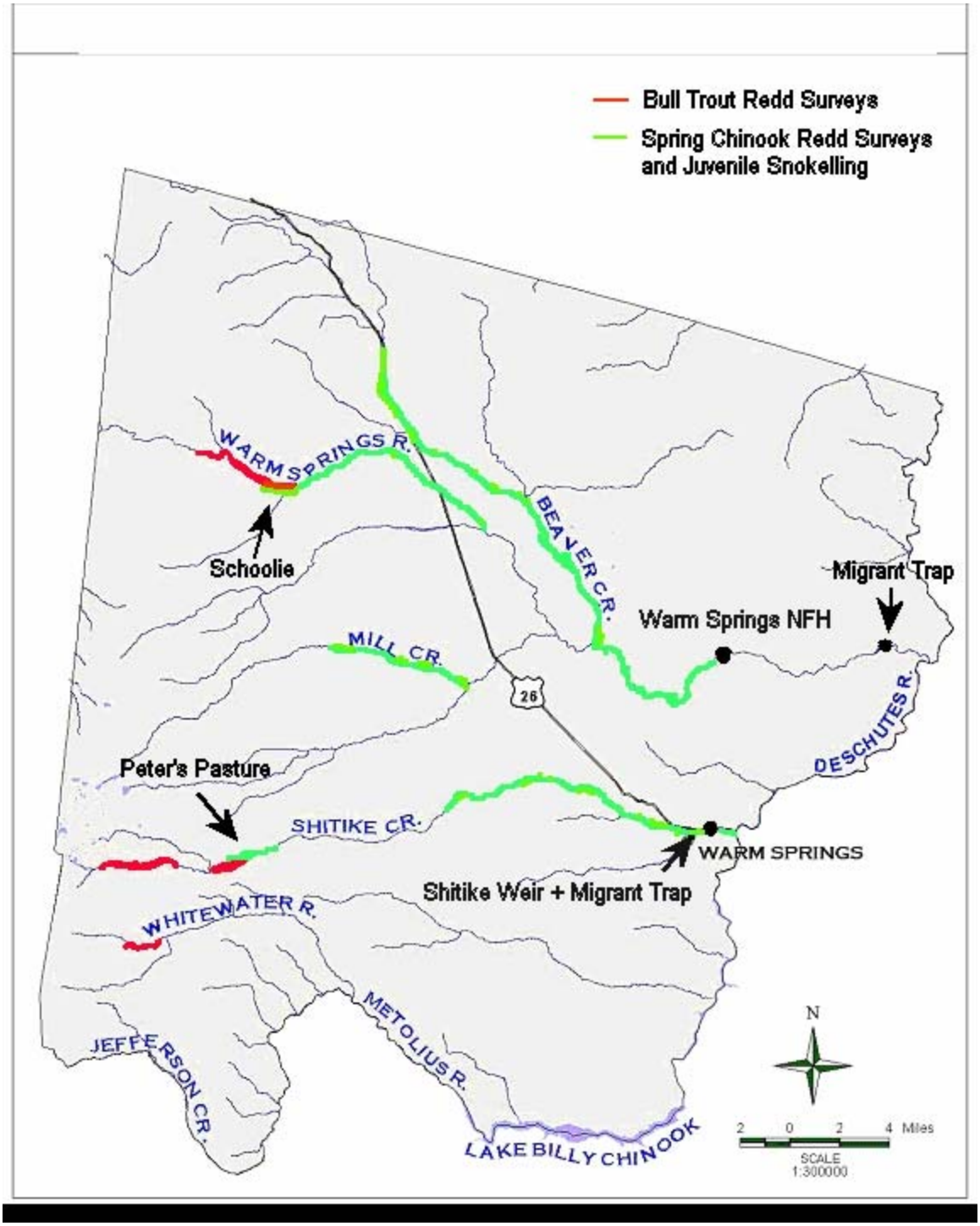

Figure 1. Map of spring Chinook monitoring activities on the Warm Springs River and Shitike Creek. Bull trout survey areas are from Brun and Dodson 2001.

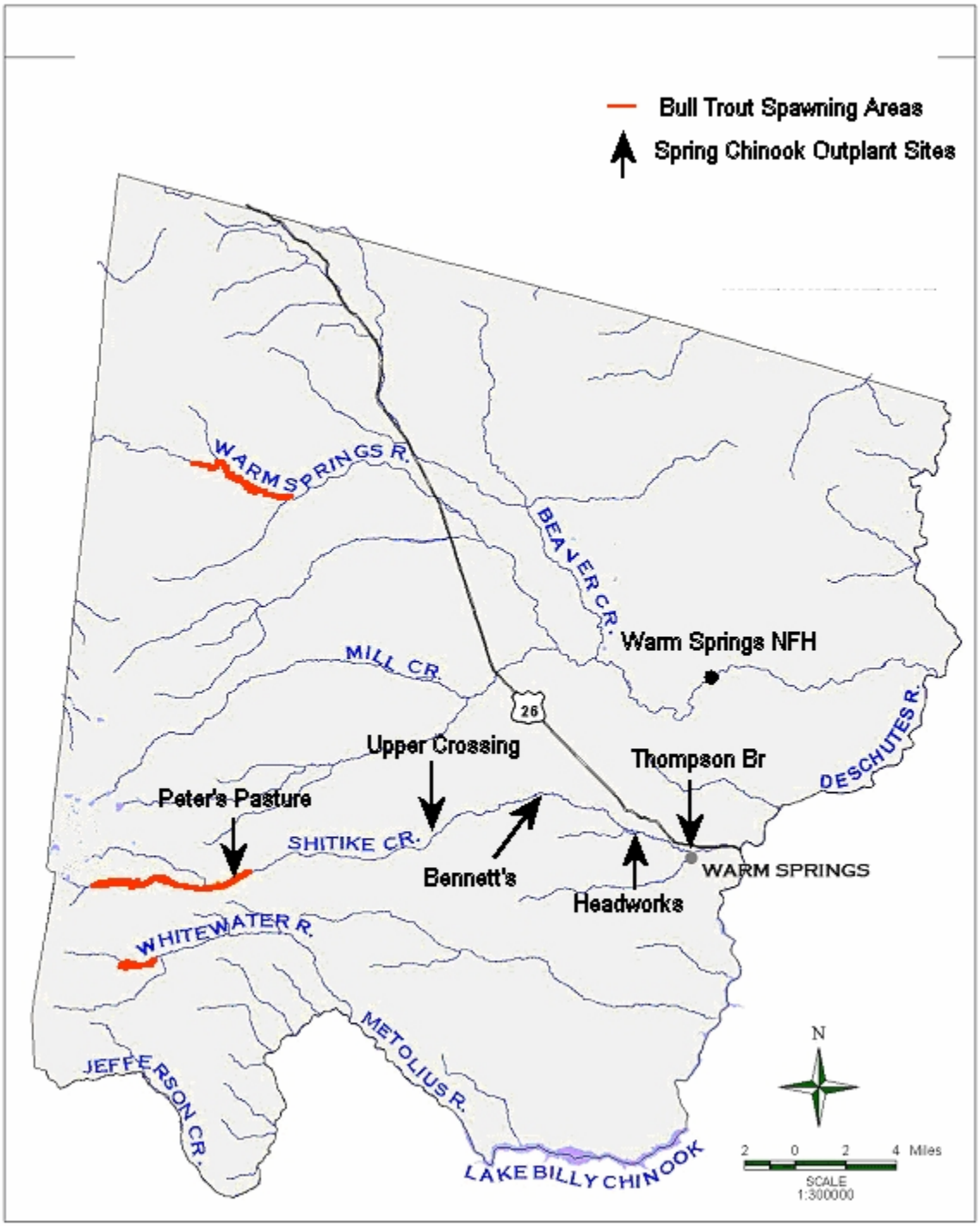

Figure 2. Hatchery spring Chinook salmon outplanting sites on Shitike Creek. Known bull trout spawning areas are taken from bull trout spawning surveys (Brun and Dodson 2001).

15.5 References

Brun, C. 1999. Bull trout distribution and abundance in the waters on and bordering the Warm Springs Reservation. 1999 Annual Report. Confederated Tribes of the Warm Springs Reservation, Oregon. Prepared for the Bonneville Power Administration Project Number 1994-054.

Brun, C. and R. Dodson, 2001. Bull trout distribution and abundance in the waters on and bordering the Warm Springs Reservation. 2001 Annual Report. Confederated Tribes of the Warm Springs Reservation, Oregon. Prepared for the Bonneville Power Administration Project Number 1994-054.

CRiS (Columbia River Information System) Database, Stephen Pastor Database Manager (Stephen_Pastor@fws.gov), United States Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, Washington. http://columbiariver.fws.gov

CTWSRO (Confederated Tribes of the Warm Springs Reservation of Oregon) and USFWS (United States Fish and Wildlife Service), 2002. Warm Springs National Fish Hatchery Operational and Implementation Plan 2002-2006. United States Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, Washington.

Dambacher, J. M. , 2002. Project Report: Relative abundance of juvenile Chinook salmon in Shitike Creek, of the Confederate Tribes of the Warm Springs Reservation, Oregon. Oregon Department of Fish and Wildlife, Corvallis, OR.

Ewing, R. D., B.P. McPherson and T.D. Satterhwaite. 1990. Effects of Varied Rearing Temperatures and Feeding Regimes on Retention of Bismark Brown Y Stain in Alevins of Chinook Salmon. The Progressive Fish-Culturist 52: 231-240.

IHOT (Integrated Hatchery Operations Team), 1996. Operations Plans for (USFWS) anadromous fish production facilities in the Columbia River Basin. Annual Report to the Bonneville Power Administration, Portland, Oregon.

Olson, D. E. and S. Pastor, 1998. Warm Springs National Fish Hatchery: An account of summer steelhead returns and strays in the Warm Springs River. U. S. Fish and Wildlife Service, Columbia River Fisheries Program Office, Vancouver, Washington.

Rieman, B.E. and J.D McIntyre. 1993. Demographic and habitat requirements for conservation of bull trout. U.S. Forest Service Intermountain Research Station General Technical Report INT-302.

Take Table 1. Estimated steelhead take levels in the Warm Springs River for hatchery monitoring activities.

Listed species affected: Steelhead ESU/Population: Mid-Columbia ESU Activity: Hatchery Monitoring				
Location of hatchery activity: Warm Springs River Dates of activity: January 1-December 31 **Hatchery program operator: USFWS Hatchery Operation + Monitoring, CTWSRO Monitoring**				
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt[1]	Adult	Carcass
Observe or harass a) CTWSRO spawning surveys	-	-	<700-wild	<25
Collect for transport b)	-	-	-	-
Capture, handle, and release c) Rotary screw trap **Hatchery fish ladder**	-	<8,000	<1000-wild	-
Capture, handle, tag/mark/tissue sample, and released) **Hatchery fish ladder** **Rotary screw trap** **Snorkel (mark-recap)**		<1,000 <500	<1000-wild	-
Removal (e.g. broodstock) e)	-	-	-	-
Intentional lethal take f)	-	-	1000-stray hatchery	-
Unintentional lethal take g) all activities	-	<50	<5-wild	-
Other Take (specify) h)	-	-	-	-

[1] Juvenile steelhead and juvenile resident rainbow trout are visually indistinguishable and are combined for estimated take purposes

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.

b. Take associated with weir or trapping operations where listed fish are captured and transported for release.

c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.

d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.

e. Listed fish removed from the wild and collected for use as broodstock.

f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.

Take Table 2. Estimated steelhead take levels in Shitike Creek for hatchery monitoring activities.

Listed species affected: Summer Steelhead ESU/Population: Mid-Columbia River ESU Activity: Hatchery Monitoring				
Location of hatchery activity: Shitike Creek Dates of activity: January 1-December 31 Hatchery program operator: USFWS				
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt[1]	Adult	Carcass
Observe or harass a) Snorkel surveys **Snorkel surveys+redd surveys**	-	<1,000	<100	50
Collect for transport b)	-	-	-	-
Capture, handle, and release c) Rotary screw trap **Adult weir**	-	<8,000	<30 (kelts)	-
Capture, handle, tag/mark/tissue sample, and released) **Rotary screw trap** **Snorkel (mark-recap)** **Adult weir**	-	<2,000 <500	<300	-
Removal (e.g. broodstock) e)	-	-	-	-
Intentional lethal take f)	-	-	-	-
Unintentional lethal take g) all activities	-	<50	< 5	-
Other Take (specify) h)	-	-	-	-

[1] Juvenile steelhead and juvenile resident rainbow trout are visually indistinguishable and are combined for estimated take purposes.

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.

g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.

Table 3. Estimated bull trout take levels in the Warm Springs River for monitoring activities.

Listed species affected: Bull Trout ESU/Population: Columbia River Population Segment Activity: Hatchery and Monitoring				
Location of hatchery activity: Warm Springs River Dates of activity: January 1-December 31 **Hatchery program operator: USFWS Hatchery Operation + Monitoring, CTWSRO Monitoring**				
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a) Automated passage system/ladder Spring Chinook Redd Surveys Juvenile Snorkelling	-	- - <4	<20 <5 <4	-
Collect for transport b)	-	-	-	-
Capture, handle, and release c) Sorting at the Hatchery	-	-	<20	-
Capture, handle, tag/mark/tissue sample, and released) Migrant Trap	-	<4	-	-
Removal (e.g. broodstock) e)	-	-	-	-
Intentional lethal take f)	-	-	-	-
Unintentional lethal take g) Total	-	1	1	-
Other Take (specify) h)	-	-	-	-

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.

Take Table 4. Estimated bull trout take levels in Shitike Creek for hatchery monitoring activities.

Listed species affected: Bull Trout ESU/Population: Columbia River Population Segment Activity: Hatchery Monitoring				
Location of hatchery activity: Shitike Creek Dates of activity:_January 1-December 31 **Hatchery program operator: USFWS Hatchery and Monitoring, CTWSRO Monitoring**				
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)*[1]**			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a) Juv. Abundance and Behavioral Chinook Redd Surveys + Telemetry	-	<150 -	<10 <5	-
Collect for transport b)	-	-	-	-
Capture, handle, and release c) Adult Weir	-	-	<100	-
Capture, handle, tag/mark/tissue sample, and released) Migrant Trap	-	<125	-	-
Removal (e.g. broodstock) e)	-	-	-	-
Intentional lethal take f)	-	-	-	-
Unintentional lethal take g) Total	-	1	1	-
Other Take (specify) h)	-	-	-	-

[1]Take levels are for monitoring activities in Shitike Creek. Activities include the operation of a rotary screw trap, steelhead and spring Chinook spawning surveys, and snorkel surveys for juvenile population estimates and habitat preferences.

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.